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POLISH INDUSTRIAL STATISTICS

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POLISH INDUSTRIAL STATISTICS

II. ORGANIZATION AND SYSTEM OF INDUSTRIAL STATISTICS STUDIES

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1. Statistical Services

In accordance with legal regulations, the central organ of state administration in the field of statistics is GUS [Glowny Urzad Statystyczny -- Main Bureau of Statistics]. The decree of 31 July 1946 regarding the organization of state statistics and regarding GUS (Dz. U. [Dziennik Ustaw -- Legal Gazette], No 41, position 239) places upon GUS the task of conducting statistical studies relating to the needs of economic planning, specifically the compilation of statistical data on the completion of economic plans and the duty of coordinating and supervising in a trained manner studies and reports by specific organs of state administration and other organizational units of the national economy.

The above-mentioned decree introduces the principle of centralized state statistics. This of course does not imply the establishment of a monopoly of statistical studies within GUS and the organs subject to it, since the decree also permits statistical studies by other bureaus and organizational units. The centralization of state statistics depends solely on the fact that it insures the systematic uniformity resulting from the coordinated supervision of all statistical studies by one central office and that basic research is directed by GUS.

The direction of affairs relating to industrial statistics rests with the department of industrial statistics in GUS.

Local organs of the state administration of industrial statistics created by the resolution of the Council of Ministers of 10 January 1953, Monitor Polski [Polish Monitor], No A-II, positions 151, 152, and 153) are the statistical divisions of the presidiums of the Wojewodztwo national

councils, national councils of some of the larger cities, and the powiat statistician at the powiat level.

Within the scope of the local branches fall matters of organization, coordination, inspection, and control of statistical reports made by offices and organizational units of the national economy, especially matters of combatting illegal statistical reporting.

The scope of activities of local statistical agencies in the field of industrial statistics are defined in detail by instructions issued by GUS.

Outside of the above-mentioned central and local agencies of state administration in the field of statistics, specific bureaus and organizational units of the national economy have their own statistical cells which conduct statistical studies standardized by GUS or carry out statistical reporting work in accordance with instructions and on forms issued by GUS.

2. System of Reporting in Industry

The gathering of statistical data in industry is done in principle exclusively on the basis of statistical reports submitted periodically by reporting units.

Other methods of statistical observation such as, for example, questionnaires, industrial lists, etc, are used rather rarely in our practice and do not play any significant role.

Statistical reporting work is now conducted in Poland in accordance with the decree regarding the organization of state statistics and GUS of 31 July 1946 (Dz. U., No 41, 1946, position 239) and according to the program established by resolution No 196 of the Government Presidium of 22 March 1952 in the matter of the program of statistical reporting works (Monitor Polski, No A-28, 1952, position 410).

In accordance with this presidium resolution, No 196, statistical reporting works within the scope of GUS are conducted exclusively on instructions and forms issued by GUS and approved -- formerly by the chairman of the state commission for economic planning, and following the law of 28 March 1952 relating to the change in scope of activity of the chief authorities in the field of state statistics (Dz. U., No 18, position 109) -- by the Chairman of the Council of Ministers. The instructions of the GUS also includes forms for reports concerning financial statistics of enterprises worked out by the Ministry of Finance.

The GUS Bureau of Statistics issues instructions regarding statistical reporting works for heavy and medium industry and separate directives of a considerably smaller reportorial scope for the small industries.

Heavy and medium industry comprise essentially industrial enterprises subject to the Industrial Department as for example the ministries of Mining, Metallurgy, Machinery, Power Supply, Light Industry, Chemical, Wood Pulp, Construction Materials, Agricultural and Food Products, and Meat and Dairy Industries.

Small industries are essentially enterprises under the ministries of Small Industries and Crafts, Internal Trade, State Farms, Labor and Social Security, Cooperative Economy, and the central bureau of vocational training.

Furthermore by the order of the Council of Ministers of 29 July 1950 Dz. U., No 33, position 299) the GUS Bureau of Statistics issues separate instructions regarding statistical reporting of private and trade shops.

The reportorial scope of industrial enterprises listed under heavy

and medium industries is wide. These enterprises submit monthly reports regarding capital and medium repairs, industrial production quota fulfillment by quantity and value, quota fulfillment for production grades, employment, work hours and productivity, wage fund quota fulfillment, materials supply, marketing of industrial production and wojewodztwo supply stockpiling, work norm execution in constant fuel volume and scrap metal supply quota fulfillment, as well as some financial reports.

They submit quarterly reports regarding time utilization of machinery and equipment, production quality control, basic quantities, technical and economic indices, petroleum products volume, quota fulfillment of material and technical supplies, quota fulfillment of material turn-over and management of economically superfluous surpluses, consumption of materials, utilization of financial means for work safety and hygiene, output incentives, improvements suggested by efficiency experts, intraplant training, as well as some financial reports.

Once yearly industrial enterprises submit reports relative to the fulfillment of the annual technical, industrial, and financial quota, the yearly power quota, the state and composition of employment, etc.

Over and above that, on the basis of the resolution of the economic committee of the Council of Ministers of 6 February 1948, some industrial enterprises must file daily, 10-day, and monthly telegraphic reports in the field of the more important industrial products.

Besides the statistical reports covered by the instructions of GUS which we discussed above, industrial units also submit so-called "internal" reports, essential to the control of fulfilling intraplant quotas or for other needs of the agencies under its control. All internal statistical reporting works can only be conducted on the basis of the

decision of the proper authority after the approval of instructions and report forms by the President of GUS.

The manner of approving internal statistical reporting works is regulated by Resolution No 513 of the Government Presidium of 1 July 1952 (Monitor Polski, No A-62, position 939). According to this resolution, by internal statistical reporting works are understood all presentations of figures compiled once or periodically for statistical purposes or for the operative control of activity, submitted by the reporting unit to an outside agency, whether they be submitted as forms, questionnaires, or telephone and telegraphic reports.

The request for the approval of internal statistical reporting works can be granted only by the proper authority and should meet the following requirements.

1. The application should carry an outline of the purpose for which the proposed statistical reporting works is being undertaken. In particular the applicant should explain why the statistical data contained in the required state statistical report forms are not sufficient for the applicant's needs.

2. The applicant cannot limit himself to a general description of projected reporting but must submit concrete models of the forms drawn up in accordance with the principles of statistical methods and techniques.

3. The application should be accompanied by printed models of the documents of the basis material containing the data essential to the compilation of the proposed report, for example, time-keeping cards, pay rolls, attendance records, stock cards, etc. The point is that the applicant should have a clear picture of the documentation from which data will be drawn

for the proposed report and of the amount of work connected with its compilation.

4. The applicant is also obliged to work out detailed instructions explaining the manner in which the forms are to be filled, defining the manner and the periods in which the reports are to be filed and containing a list of report recipients.

5. The applicant is obliged to present models of a collation of obtained statistical data which in essence means that he should explain the method of collating and presenting data. The President of GUS may require the applicant to forward copies of the above collations.

The discussed Resolution Number 513 of the Government Presidium finally establishes the general principle that the applicant who undertakes statistical reporting works approved by the President of GUS is obliged to supply to reporting units instructions and forms in a quantity sufficient to make the reports and their copies during the entire period for which the reporting obligation was undertaken.

Resolution of the Government Presidium Number Number 513 was the legal forerunner of effectively combatting excesses in internal reporting or so-called "wild" reporting. At present there exists the obligation to compile reports only on those forms that have the imprint showing that they were either issued or approved by GUS. Compiling reports on forms which do not have this imprint is forbidden.

Ministers (directors of central bureaus) are obliged to send to reporting units under their direction a statement of reports approved by the president of GUS which those units must submit (see model given below).

STATEMENT OF REPORTS NO________

Model 1/II

1. Ministry (central bureau)________________________

2. Reporting unit required to submit the reports included in the statement________________

Series No	Form symbol	Title of report	Period covered (month, quarter, year, one-time, etc	Date submitted	No of copies	Subdivision (name units receiving report)	Kind of report (mail, phone, wire)	Legal basis of report

In accordance with the regulations of Paragraph 11 of Resolution No 196 of the Government Presidium of 22 March 1952, persons introducing statistical forms and instructions not approved by the proper authorities are liable to disciplinary action.

All figures submitted in reports must be in agreement with the truth and based on the proper documents or on bookkeeping entries. Summary reports should be compiled exclusively from the reports of the subject reporting units and must be complete, that is, should comprise all subject units.

Binding legal regulations treat the submission of false data in reporting as a conscious legal offense. In one of its verdicts the Supreme Court established that: "Reporting in the field of planned economy is such an important element in the control of economic quota fulfillments that a conscious rendering of results of the planned fulfillment not in accordance with reality constitutes an infringement on property protected by Article 286 KK [Kodeks karny -- Penal Code] (if it is not a more serious offense" (Panstwo i Prawo [State and Law], No 8-9, 1952, pages 380-381)).

Instructions of GUS contained detailed listings for the periods of compiling unit and summary reports as well as the names of the units that are to receive them (so called, "recipients"). Other units not mentioned in this listing, therefore not participating because of service association or supervision in the course of statistical reports, may obtain copies of statistical reports only in cases foreseen in applicable legal regulations.

On the basis of the Government Presidium Resolution No 426 of 13 June 1953 (Monitor Polski, No A-62, position 758) trade unions receive

copies of certain statistical reports. In particular, factory councils receive copies of reports on plan fulfillment, covering labor hours and productivity, payroll funds, utilization of financial means for work safety and hygiene, as well as reports regarding work incentive participation, workers' efficiency improvements, work norm fulfillment, and social action.

The Central Council of Trade Unions and the chief administrative bodies of trade unions receive copies of summary reports on plan fulfillment, covering production according to value, employment, productivity according to value, and other reports mentioned above, copies of which go to the factory councils.

3. Industrial Tabulations

Besides statistical reports, statistical data in the field of industry can also be gathered from industrial tabulations.

The subject matter of a tabulation is most frequently unsubstantiated phenomena which require direct study and description. In this, among other things, the tabulation essentially differs from one-time reports which are compiled on the basis of substantiated data.

The generality and completeness of the substantiation system in socialist countries makes it possible to base all statistical studies on reporting.

Statistical studies with the aid of industrial tabulation are conducted in these countries only in cases where the studied phenomenon is not registered or substantiated or in exceptional cases which we will discuss below.

In People's Poland an industrial tabulation was conducted barely 3 months after the cessation of hostilities, namely in the period from

15 to 30 July 1945.

The necessity of conducting a tabulation of industrial plants stemmed from the fact that the division of industrial statistics of GUS, newly organized in May 1945, had no data whatsoever concerning the number or location of industrial plants.

The data gained as a result of the tabulation enabled the rapid acquisition of the most essential information in the field of industry. Furthermore, on the basis of the tabulated data, it was possible to set up a card index of industrial plants without which it would have been impossible to approach any statistical studies whatsoever.

The industrial plant, according to the usage of prewar tax regulations, was adopted as a tabulation unit. (Law of 25 April 1938, regarding registration fees from enterprises and occupations (Dz. U. No 34, position 293).) The tabulation comprised all industrial plants, active or inactive, as well as craft workshops employing 5 or more workers.

The tabulation was conducted on the order of the Minister of Public Administration in conjunction with the Minister of Industry of 28 June 1945. Executing agencies were the industrial divisions of wojewodztwo boards and the industrial starostwo "referats."

The tabulation form contained questions concerning: name, address and year of establishment of the plant; definition of its legal character and, in the case of privately owned plants, its legal form (joint stock company, limited company, limited partnership, open partnership, privately owned firm); organizational affiliation of plant; actual employment figures and maximum possible employment with existing facilities, power producing machinery with enumeration of machines and steam turbines, internal combustion engines, hydraulic and other power producing engines and a record of

outside electrical power requirements; percentage of damage to buildings, power supply and technical facilities of the plant; chief items of production before the war and at the time of the tabulation.

The data obtained from the tabulation were segregated according to branches and groups of industry as well as by wojewodztwos (Table 1/II). Furthermore the data concerning the number of the plants and the percentage of their damage were segregated according to the number of workers employed in them (Table 2/II).

TABLE 1/11

NUMBER OF PLANTS, EMPLOYMENT, AND CAPACITY OF INSTALLED POWER PRODUCING MACHINES

15-31 July 1945

Number of Plants				Number of workers in active plants		Number of plants having generators and power machines	
Total	Inactive	For which data are lacking	Active	At time of tabulation	At maximum capacity	Plants	Power in hp
30,017	8,122	1,014	20,881	738,329	1,408,523	12,598	4,480,454

Source: Spis zakladow przemyslowych 1945 [Tabulation of Industrial Plants 1945], 1947, Warsaw, GUS, page 2

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TABLE 2/II

NUMBER OF PLANTS ACCORDING TO SIZE

15-31 JULY 1945

Plants according to no of employed	Total	Including damaged	Having Damaged Industrial buildings	Power supply	Technical equipment
Total	30,017	19,592	14,072	8,466	16,788
1-5	7,622	4,804	3,090	1,277	3,830
6-15	6,402	3,780	2,431	1,281	3,236
16-25	2,317	1,400	958	486	1,176
26-50	2,664	1,715	1,275	675	1,482
51-200	2,474	1,558	1,165	689	1,343
201-500	636	402	319	210	363
501-1000	235	142	122	69	125
1,001-and more	229	145	113	86	119
No data	7,438	5,646	4,599	3,693	5,114

Source: Spis zakladow przemyslowych 1945, 1947, Warsaw, GUS.

4. The Reporting Unit in Industrial Statistics

By a reporting unit is meant an organizational unit which under binding regulations must compile and submit statistical reports to recipients defined in these regulations.

Obliged to submit statistical reports are the basic reporting units which are in effect the industrial enterprises or, in exceptional cases, industrial plants.

The compilation of basic unit reports is drawn from first hand documentation or from the internal reports of the reporting units. Unit reports are categorically compiled by the proper organizational cells of the industrial enterprises under the direction and supervision of the statistical cell.

It is necessary to differentiate between basic reporting units and the so-called internal units, the latter being an organizational unit that, while entering into the make-up of the enterprise, does not have full economic accounting status and is required to submit internal reports which in turn constitutes the basis for the compiling of reports by the basic reporting units.

On the basis of the unit reports of the basic reporting units or the industrial enterprises, supervisory reporting units, which are actually the central industrial boards and ministries, compile summary reports according to the listings established by GUS.

Supervisory reporting units direct the activities of the basic reporting units under their jurisdiction in the field of industry; run a card index which furnishes proof of receipt and delivery of reports, and verify the reliability, correctness, and priority of these reports.

The selection of the proper reporting unit and the strict definition of its character has an important bearing on the success of the statistical study.

In the first postwar period in People's Poland GUS used 2 reporting units for the starting point of its statistical studies in industry, the industrial plant and the industrial enterprise.

In the GUS instructions of that time an industrial plant was defined as a unit "having a uniform type of production and separate premises," and an industrial enterprise as "an economic body equipped with legal status, acting independently in the realization of plans and having a separate economic account (balance)."

The then existing organizational state of industrial enterprises frequently composed of several separate industrial plants located in various parts of the country (for example, the Warsaw Tanneries, with head office in Warsaw, comprised tanneries in Warsaw, Lomianki, Zyrardow, Grodzisk, Lidzbark, Biaystok, and Lublin) made it impossible to work out, in a territorial sense, the results of statistical investigations based on the reports of industrial enterprises. Moreover some multiplant enterprises composed of plants engaged in various kinds of production (for example, a mill, a saw mill, and a brick works) made it impossible to clearly chart results pertaining to the various industrial branches.

In view of this situation it was then necessary to adopt as a reporting unit not only the enterprise but the industrial plant.

The necessity of operating in parallel 2 types of reporting units was eliminated by the reorganization of industrial enterprises under socialism, in accordance with the resolution of the economic committee of the Council of Ministers of 12 May 1950, relating to the organizational

structure of the socialized enterprises of the key industries, the central boards of industry, and trusts. In this resolution it was established that "the basic economic unit of the key industry should be the single plant enterprise acting within the scope of the National Economic Plan on the principle of economic accounting."

The establishment of the principle that the industrial enterprise is a one plant enterprise bore great significance for the further development of statistical studies. This principle created the basis essential to the conduct of effective control of plan fulfillment by individual one-plant enterprises. Figure data contained in reports of previously existing multiplant enterprises made it difficult to conduct a correct analysis of quota fulfillment by single enterprises, since total figures in the reports of the enterprise on many occasions comprised the sum of data for plants which did not meet their quotas and for plants which markedly exceeded theirs. Thus the gross figures contained in the reports of the multiplant enterprise sometimes obscured the picture of the actual state of affairs in individual factories which were included in the composition of the enterprise and made it impossible to bring to light unutilized reserves in individual plants.

Beginning with 1951 the basic reporting unit in industry became the enterprise, essentially one-plant, acting within the framework of the national economic plan adhering to the principle of economic accounting.

An enterprise composed of several independent plants (divisions) located in various areas submits a single report. If however, these plants belong to several branches of industry (for example, flour mill and saw mill, foundry and coke oven, etc) this enterprise submits several separate reports for each plant.

Enterprises generating their own power to 500 kw or better have to submit special reports to the Ministry of Power Supply.

Superintendent reporting units (central industrial boards, equivalent units and ministries), on the basis of subordinate reports, submit biannually summary reports relating to gross value of production for each separate branch of industry and according to economic groups A and B.

The precisely defined concept of the reporting unit has now removed all prior difficulties. In accordance with the regulation of the Council of Ministers of 10 January 1952 regarding the establishment and compilation of the register of state enterprises (Dz. U., No 3, position 22), all industrial enterprises must be listed in the register of state enterprises. In Part A of the register are listed those enterprises which do their accounting with the state budget via the central budget or are included in it. In Part B are listed those enterprises which do their accounting with the state budget via the area budgets or are included in them. Together with the name of the enterprise, the register lists the organizational units of that enterprise, conducted according to the principles of complete internal economic accounting.

In each one-plant industrial enterprises, we can distinguish the following 3 basic types of internal organizational cells: (a) productive, (b) nonproductive, and (c) functional.

In the production cells, also called "mobile" cells, is centered the production activity called for by the character of the given enterprise.

Production cells may be (a) basic and (b) service.

In the basic cells are directly created and executed the industrial products and functions assigned to the given enterprise.

For example, among the basic cells of the textile industry enterprises are spinning, weaving, dyeing, and finishing and in the machine-building industry, foundry, forging, machining, assembly, etc.

In the service cells is executed the production activity pertaining to the servicing of the basic cells, maintainance of work equipment, heat, gas, and electrical power supply, as well as the output of wrapping material for the production cells. To the service cells belong tool rooms, pattern shops, power stations of all kinds, wrapping material producing departments, etc.

In the service cells is executed production activity servicing not only the basic cells, but also the enterprise as a whole, as for example inter and intradepartmental transportation, storage facilities, repair shops for production equipment, etc.

The activity of the nonproductive cells of an enterprise is centered on the conditions of life and culture of the workers of the given enterprise. They include community restaurants, first-aid stations, nurseries, kindergartens, workers' centers, etc.

Functional cells do not participate directly in the production process and their function is administrative. To the functional cells belong the specific administrative divisions of the enterprise such as the bookkeeping, planning, statistical, personnel, etc departments which are included in the category of "administration."

5. Groupings in Industrial Statistics

Grouping, as is known, constitutes the basic method of statistical studies.

Depending upon the purpose of the investigation, various types of grouping are applied, and in each case the grouping is intended to bring to light the significant quality difference of the studied phenomenon.

The grouping of industrial plants is very significant, since other elements of statistical study, such as industrial production, employment, wages, durable means, etc are also grouped accordingly.

Below are given the most basic groupings of industrial plants as applied in industrial statistics. Other groupings, applied exclusively in the study of specific phenomena (employment, wages, etc) will be described in other chapters devoted to the discussion of these phenomena.

Production (Branch) Classification of Industrial Plants

By the production classification of industrial plants is meant their grouping according to the one kind of product they produce.

All industrial plants belonging to one phase of the national economy, that is, to industry, are divided into branches. Specific industrial branches comprise those plants which are most similar in the kind of product they manufacture. Each branch of industry is divided into groups, and each group of industry is in turn divided into various kinds.

The production classification of industrial plants is applied equally in planning as in statistics.

On the basis of a correctly formulated classification of industrial plants, the national economic plans establish planned proportions between the magnitude of production, employment, etc of the specific branches of industry. Statistics, in turn, reveal the course of fulfillment of plan quotas and point to the eventual appearance of disproportions arising in the process of fulfilling the plan.

Formulation of the production classification of industrial plants is based on the lasting objective traits pertaining to the character of production of these plants, guaranteeing the comparability of the statistical data for various periods of time. Such comparability is not obtainable when industrial plants are grouped, let us say, according to departmental affiliation, because of organizational changes which occur in the national economy.

The basic trait, according to which classification of industrial plants is formulated, is that of the designation of the production, since many industrial plants vary primarily in what they produce. Some plants mine coal, others produce machines, and still others, textiles, or sugar, etc. The kind of product produced by the industrial plant constitutes its basic trait, since this trait defines at the same time other traits of the plant, such as the kinds of raw materials used, kinds of machinery and equipment in use, kind of qualification of trade workers employed, etc.

It should be emphasized that the designation of production was the accepted basis for industrial plant classification in Polish statistics even in the prewar period.

"As the most objective, measurable, statistically graspable classification trait of a workshop, the phenomenon of its activity, which for industrial enterprises is the kind of merchandise which it manufactures and releases to the market, has been accepted.

"Since specific industrial plants manufacture a set of items the production of which depends upon the facilities existing in the plant and the trade qualifications of its employees, the set of items manufactured there can be accepted as an objective index of the productive capacity of that plant" (Statystyka Przemyslowa 1935 [Industrial Statistics 1935], GUS 1937, page IX).

The consequent following of the principle of classifying industrial plants by designation of manufactured products is not always possible. In some cases, items of the same designation are manufactured in such a basically different manner, by means of entirely different tools, machinery, and industrial equipment, and of entirely different raw materials. In such cases, the designation of the production does not have the significance of the basic trait defining other true traits of the industrial plant.

Let us take for example an industrial plant manufacturing wood and metal furniture, or a factory making leather and rubber footwear. It is a fact that in these cases the designation of the production (furniture, footwear) does not constitute a basic trait, since the manner of producing metal furniture differs fundamentally from the manner of producing wooden ones. Equipment and machinery differ, raw materials are not the same, and the trade qualifications of the employed workers are not the same. Similar difficulties arise in the classification of leather and rubber footwear. In connection with this, there arises the necessity in justified cases of also using other criteria in the production classification of industrial plants, such as kind of raw materials used or the technical process employed in production. The criteria mentioned are of an auxiliary nature only and are applied only in cases where the designation of the product does not have the nature of a basic trait.

Omitting considerations of a basic nature, one should point out that the kind of raw materials used as well as the nature of the technical process used in production cannot be accepted as the only criteria for the classification of industrial plants. Let us take, for example, lumber as a raw material. Thanks to achievements of modern technical science, the same raw material is used in factories producing items of various designations, by means of different machinery and equipment, and by workers of various trade qualifications. Lumber serves as raw material in the lumber industry producing furniture or construction lumber. Lumber serves also as a basic raw material in the pulp and paper industry, and in the production of some artificial fibers in the textile industry. The classification of all these various types of industrial plants into one group would indeed be economically senseless.

Neither can the nature of the technical process used serve as a basic criterion in the classification of industrial plants. It plays only an auxiliary part in the grouping of industrial enterprises in the further stages of classification.

The successful selection of the proper classification unit plays a tremendous role in the correct production classification of industry.

In Poland the industrial plant, or the unit having a uniform type of production and separate premises, has been adopted as the unit of production classification of industry.

A multiplant enterprise cannot be accepted as a classification unit in view of the infinite number of possible combinations of different kinds of industrial plants within the framework of one enterprise.

In some capitalist countries (Germany, Belgium) in the prewar period, the so called "technical unit" was used as a classification unit.

By a "technical unit" is understood a distinct and complete stage of the production process essential to a definite product or process. In this sense, getting out ice by workers in a brewery for the needs of that plant or the forging in a foundry constitute a separate "technical unit." As a basis for the definition of the "technical unit" thus are accepted traits concerning the technical organization of production, dividing the technological process of production into such centers or stages which supposedly cannot be further subdivided.

The basing of production classification of industry on the "technical unit" did not meet the practical tests. The selection of this classification unit led to a situation where items of a long production cycle, for example, machine building, was broken down into many minute technical units, and as a result a false picture of a supposed fractioning and deconcentration of heavy industry was obtained. In many cases it was impossible to separate the "technical unit" and establish the beginning and the end of this "separate stage of the production process." Furthermore results of other statistical studies, for example, in the field of employment, wages, production costs, etc, could not be tied in with specific "technical units," since these results concerned the plant as a whole and not its individual "technical units."

Similar difficulties arise in the selection of the so-called "operation unit" as the classification unit. By an "operation unit" is meant certain kinds of operations performed within the framework of one industrial plant, for example the transportation operation, power operation, etc.

The correct classification of a plant into a defined branch group, or kind of industry does not create any difficulty if the plant produces one type of products (for example a hard coal mine, cement works, nail factory, etc).

Certain difficulties arise however in cases where the industrial plant at the same time produces products belonging within the scope of production of plants belonging to various branch, group, or type classifications, as for example, when a brickworks produces bricks and tiles, or when a tile factory produces not only tiles but also glazing, etc. In such cases it is customary to classify the industrial plant according to that production which predominates in the factory. The magnitude of production can be defined either according to value production or according to the number of workers employed for the various products.

It is accepted as a principle that industrial plants are classified according to the final product of a given plant and not according to the intermediary products or so called half products which result from completion of intermediary phases of the production process. If, for example, in a factory producing farm machinery, certain farm machinery parts are also cast in the factory foundry, this factory is always classified as a farm machinery plant and not as a foundry.

It should be emphasized that transitional changes of the production program do not affect the classification of the industrial plant. If, for example, a bicycle factory temporarily produced kitchen utensils for a certain period of time, this factory is continued to be classified under the production of bicycles and not of utensils. This is intended to prevent the creation of comparison difficulties in the use of statistical data due to frequent changes in classification. Only in cases where the change of program has a lasting character should a change in classification follow.

A characteristic trait of production classification of industrial plants is its contents. An exaggerated expansion of classification and

its excessive subdivision is not recommended, since it leads to an obscure picture of the production types of industrial plants and causes the classification of plants to change into a listing of products.

The above discussion aims to point out the desirability of a maximal stability of the production classification of industrial plants in order to secure the comparability of statistical data. One should, however, keep in mind that such a stabilization is relative. As a result of rapid technical progress, new branches of production are formed, the production of items formerly not produced in the country is developing, or the technological process of production may change radically. This in turn, makes it necessary to revise classifications or to make them more complete. Furthermore the broadened scope of statistical methods requires changes in the existing classification. For this reason it is essential to establish a so-called numerical key, which will permit the change from one classification to the other in retrospective statistical studies.

In 1947 in People's Poland a new classification was worked out and introduced in which the entire industry was divided into the following 24 branches.

1. Mining
2. Mineral industry
3. Metallurgical industry
4. Metallic industry
5. Electrotechnical industry
6. Optical and precision instruments industry
7. Fuel oil industry
8. Chemical industry
9. Textile industry
10. Paper industry
11. Polygraphic industry
12. Leather industry
13. Lumber industry
14. Muscial instruments industry
15. Food and farm products industry
16. Clothing industry
17. Building enterprises including building trades

18. Refrigeration industry
19. Miscellaneous industry, not specified
20. Electric power plants, transmission stations, and power and light installations
21. Water supply
22. Railroad workshops
23. Gardening, Nurseries livestock breeding, and fisheries not associated with farming
24. Payments and services

The 1947 classification was binding only for the period of the Three-Year Plan. In 1949 a new classification, which went into effect in 1950, was established which divided industrial plants into the following 28 branches.

1. Electrical power plants
2. Mining
3. Digging of other mineral raw materials
4. Building materials industry
5. Procelain and china industry
6. Glass industry
7. Metallurgical industry
8. Building machinery and construction industry
9. Means of transportation industry excluding shipbuilding
10. Shipbuilding industry
11. Light metal Industry
12. Precision and optical instruments industry
13. Electrochemical industry
14. Fuel products industry
15. Chemical industry
16. Rubber industry
17. Textile industry
18. Paper industry
19. Polygraphic industry
20. Leather and footwear industry
21. Lumber industry
22. Musical instruments industry
23. Farm products industry
24. Food industry
25. Clothing industry
26. Refrigeration industry
27. Miscellaneous, unspecified
28. Water supply

The introduction of this classification was based primarily on production methods.

Branch 17 of the old classification "building enterprises including building trades" was abolished, as these enterprises do not rightly belong to industry.

Also abolished was branch 23, "gardening, nurseries, livestock breeding, and fisheries not associated with farming," because such activities do not belong to industry with the exception of marine fishing which was included in the new classification under food industry (branch 24).

Also branch 24 "payments and services" was omitted as being in effect communal payments and services not belonging to industry.

The larger branches of industry such as minerals, chemicals, and foods, were further subdivided, and some items were transferred from one branch to another.

Progress in classification methods is shown in the new classification introduced in 1952. In this classification there is an apparent tendency to group plants by the designation of the product rather than by the technical process. This explains the disappearance of "mining" and the distribution of its plants correspondingly to Metallurgy, Fuel Production, etc.

BRANCHES OF PRODUCTION IN THE 1952 CLASSIFICATION

1. Metallurgy and the processing of iron (including the mining of the ores

2. Metallurgy and processing of nonferrous metals (including the mining of the ores)

3. Fuels Industry

4. Electric power generation

5. Machinery and equipment building industry

6. Metal and electrical appliances industry

7.. Chemical Industry (including the chemical processing of wood and coal)

8. Rubber industry

9. Pharmaceutical industry

10. Building materials industry

11. Glass industry

12. China and porcelain industry

13. Lumber and woodworking industry

14. Cellulose and paper industry

15. Fine paper and office supplies industry

16. Polygraphic industry

17. Textile industry (including hosiery and clothing)

18. Leather and footwear industry

19. Musical instruments industry

20. Food industry

21. Salt industry

22. Refrigeration industry

23. Fats and oils industry

24. Miscellaneous

The binding classification of industrial plants in the Soviet Union contains 32 industrial branches. The larger number of branches in this classification is due to the tremendous development of industry in the Soviet Union, which necessitated the establishment of new branches in the classification. (The classification is given in A. J. Jezow, Podrecznik statystyki przemslowej [Manual of Industrial Statistics], 1950, Ksiazka i Wiedza, pages 367-370.)

Grouping According to Economic Designation of Production

Karl Marx's division of material production into Part I, comprising the means of production, and Part II, comprising consumer goods, has a tremendous significance in the study of the basic line of the development of industry and the entire process of the broadened socialist economic growth. In this connection all economic plans, yearly and in perspective, contain tasks defining the dynamics of the production of means of production and of consumer goods.

The division of socialized production is made in practice along the designation of production into economic groups A and B.

Group "A", which corresponds to Part I in the Marx terminology, comprises the production of the means of production, and Group "B", corresponding to Part II, the production of consumer goods.

The introduction of this division in practice may cause serious difficulty, since the same product sometimes has a partly production designation and sometimes a nonproductive one. Electric power, coal, and fuel oils served partly as a means of production and partly as consumer goods (for example, in household use). In this connection the listing of the given product under group "A" or "B" is done according to the predominant character of its designation. Thus for example, coal is included in group "A" and salt in group "B".

Up to 1954 the division of industrial production into economic groups "A" and "B" was made by the so-called "plant" method, by which specific types of industrial plants or groups or even whole branches were incorporated into group "A" or "B" according to the predominant economic character of production. In this connection the production (branch) classification of industrial plants was related to the economic grouping of these plants. A determination of this kind facilitated work with statistical data, even though there was an awareness that such a division is arbitrary in many cases, since part of the output of industrial plants included in group "A", for example, was earmarked not only partially but entirely for consumption, that is, products belonging to group "B."

In order to increase the precision of statistical planning and studies, starting in 1954 the "plant" method of dividing production into economic groups "A" and "B" was abandoned in favor of a division determined by the predominant designation of the products.

Grouping According to Socialized Forms of Industry

Grouping of industrial plants according to socialized forms of production or according to the form of the ownership of the means of production is very important.

In an address at the Fifth Plenary Session of the Central Committee of the United Polish Workers Party on 15 July 1950, Hilary Minc stated the following.

"In industry, due to the general growth of socialized small industries, the socialist sector of the total production of industries and crafts rose from about 89% in 1949 to about 99% in 1955.

"The remaining 1% falls to the small item crafts economy, and eventually the participation of capitalist production will be reduced to hundredths of a percent" (Nowe Drogi [New Roads], No 4 (22), 1950, page 35).

In the light of the assumptions of the Six-Year Plan, and for the purposes of the socialist control of its fulfillment, industrial plants are grouped as follows.

A. Socialist industry
 a. State ownership
 b. Cooperative ownership

B. Small items industry (individual crafts)

C. Capitalist industry
 (private industry)

In the Poland of large estates and capitalism, plants were grouped according to so-called legal form dividing the plants according to their ownership by joint stock companies, corporations, limited partnerships,

firm partnerships, cooperatives, single individuals or other unknown legal forms, as well as according to the religion of the plant owners. Indeed these "groupings" are very formal and their instructive value rather limited.

Grouping According to Organizational Affiliation

Statistical studies group industrial enterprises according to their organizational affiliation with departments (ministries and central bureaus) supervisory units (central administrations, central cooperatives, and associations), etc.

The necessity of applying this type of grouping stems primarily from the fact that the national economic plan divides the plant tasks by departments, which in turn defines the plant quotas of the organizational units (central administrations of industry, central cooperatives, etc) within their jurisdiction.

Furthermore, the grouping of industrial enterprises according to their organizational affiliations enables the introduction of statistical control of the plan fulfillment. Indeed, without this grouping such control would be altogether impossible.

The binding system of reporting according to which supervisory reporting units compile their summary reports from the material submitted by the basic reporting units under their jurisdiction, in practice facilitates markedly the application of grouping by organizational affiliation.

In grouping industrial enterprises by this system one should keep in mind that departments as well as central administrations of industry sometimes comprise industrial enterprises belonging to different branches

or groups of industry. Similarly particular industrial enterprises sometimes comprise plants belonging to different branches or groups of industry. As is known we inherited from the capitalist economic system in the pre-September period many combined enterprises, comprising plants belonging to different branches of industry, as, for example, a saw mill connected with a flour mill and a brick works, etc. The combining of these plants were frequently haphazard and did not arise from the actual needs of industrial production.

It must be admitted that despite the great progress in the specialization of enterprises and central administrations of industry in People's Poland, grouping according to organizational units does not correspond with the grouping by branches. This means that grouping by organizational units does not permit the separation of groups entirely homogenous qualitatively, which, as is known is the main purpose of grouping methods. In this connection supervisory reporting units are required to compile summary reports twice yearly on the gross value of production and on employment separately for each branch of industry.

A statistical measure of branch specialization in a given organizational unit may be the ratio of workers employed in the basic branch of this unit as compared to the total number of workers.

In using the organizational affiliation method of grouping industrial enterprises, difficulties arise in those cases where organizational changes have occurred during the year under report. These changes complicate the comparability of the data concerning plan fulfillment with the planned quantities and for that matter the comparability of all dynamic factors.

In order to avoid such difficulties, regulations require that whenever reorganization of a unit has taken place during the report year, for example, in the division of a central administration, centrals be treated

as if they had existed since the beginning of the year. That means that the newly formed centrals show in the summary reports the yearly quotas for the units within their jurisdiction as well as their fulfillment from the beginning of the year and not from the time when the particular central started operation. Similarly the original central administration which turned over enterprises to the newly formed ones correspondingly decrease its yearly quotas and fulfillments from the beginning of the year.

This principle is also maintained in cases where a multiplant enterprise transfers one of its plants to another enterprise.

There is also a regulation covering the transfer of units which do not have an independent account or a separate intraplant plan. In such cases the transferring unit covers it in its report only from the beginning of the year to the date of transfer, and the receiving unit from date of transfer to the end of the year.

One should note that the transfer of certain types of equipment, machinery, and installations are not considered an organizational change.

In all cases of organizational change also the supervisory reporting units, transferring as well as receiving, must introduce the corresponding corrections in their reports or plan quotas and fulfillment as of the first of the year.

Table 3/II taken from the Roczniku Statystycznym [Statistical Yearbook of 1949] is an example of grouping by organizational affiliation.

TABLE 3/II

FULFILLMENT OF VALUE PRODUCTION PLAN IN PLANTS SUBJECT TO SOME CENTRAL ADMINISTRATIONS AND MONOPOLIES

Central Administrations Monopolies	1947	1948			1949
	Fulfillment	Quota	Fulfillment		
			in absolute figures	in % of quota	
	in million zlotys according to 1937 prices				
[1]	[2]	[3]	[4]	[5]	[6]
Total*	9,905	11,530	13,146	114.0	14,220
Including:					
Central administration of power	358	423	422	99.8	423
Central Administration of coal industry	1,593	1,731	1,856	107.2	1,930
Central administration of chemical industry	662	816	1,032	126.5	1,126
Central administration of metals industry	817	1,019	1,152	113.0	1,289
Central administration of electrotechnical industry	174	262	303	115.7	357
Central administration of textile industry	1,815	1,932	2,252	116.6	2,265
Central administration of clothing industry					309
Central administration of leather industry	139	182	216	118.9	250
Central administration of paper industry	257	289	317	109.7	371

[1]	[2]	[3]	[4]	[5]	[6]
Central administration of mineral industry	230	239	277	115.6	281
Central administration of lumber industry	70	89	109	122.9	118
Central administration of sugar industry	286	303	360	119.1	363
Central administration of fermentation industry	79	95	101	106.6	150
Central administration of food industry	158	234	287	122.5	167
State liquor monopoly	627	651	657	100.9	647
Polish tobacco monopoly	384	447	502	112.4	560
State match monopoly	61	71	81	113.3	79

*Excluding industrial plants subject to the Central Administration of State Farms, the Ministries of Health, Navigation, Arts and Culture, Education and Rehabilitation. Source: Rocznik Statystyczny, 1949, page 46.

Grouping by Area Distribution

One of the basic tasks of the Six-Year Plan is the industrialization of economically backward areas and the even distribution of the creative forces all over Poland.

It is known that in 1949 65.8% of the total employment in industry was centered in 4 highly industrialized wojewodztwos, Stalinograd, opole Wroclaw, and Lodz, and in the city of Lodz. The rest of Poland provided a meager 34.2%.

As a result of changes in the distribution of creative forces in Poland and the construction of new industrial plants in economically more backward areas, the portion of industrial employment in the above 4 wojewodztwos will fall in 1955 to 54.3%, and the portion of the rest of Poland will rise to 45.7% with an overall increase of industrial employment in Poland.

Statistical observation of the process of changes in the distribution of creative forces requires the grouping of industrial enterprises according to area distribution, and therefore according to economic regions as well as according to wojewodztwos, and within specific wojewodztwos according to powiats.

In grouping plants by area distribution one should bear in mind periodic changes in the administrative division of Poland. This is especially important in maintaining the comparability of studied phenomena of dynamic factors.

Below is given Table 4/II which shows the distribution of industry and crafts according to the number of workers in absolute figures and in percentages of total employment.

TABLE 4/II

DISTRIBUTION OF INDUSTRY AND CRAFTS ACCORDING TO NUMBER OF WORKERS IN 1948

Itemization	In Absolute Figures	In Percentages of Total Employment
Total workers employed	1,878,246	100.0
Wojewodztwos:		
Capital city of Warsaw	67,923	3.6
Warsaw	59,238	3.2
City of Lodz	176,033	9.4
Lodz	103,089	5.5
Kielce	95,552	5.1
Lublin	29,986	1.6
Bialystok	14,738	0.8
Olsztyn	14,668	0.8
Gdansk	62,604	3.3
Pomorze	91,501	4.9
Szczecin	45,617	2.4
Poznan	161,205	8.6
Wroclaw	231,280	12.3
Slask	545,152	29.0
Krakow	136,049	7.2
Rzeszow	43,611	2.3

Source: Rocznik Statystyczny, 1949, pages 34-35.

Grouping According to the Size of Industrial Plants

The grouping of industrial plants according to their size is of great instructive value. In the capitalist system it enables the observation of the phenomenon of the concentration of creative forces, of the

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acquisition of industry by cartels, monopolies, etc.

In a socialist system this method of grouping makes possible the deep economic study and the bringing to light, for example, of the connection between the level of productivity or production costs with the size of the industrial plant.

In the application of this kind of grouping the establishment of the criterion for division is most essential.

As the first criterion one can take the number of workers employed in an industrial plant. On this basis industrial plants can be divided into small, medium, and large, accepting, for example, as small plants those that employ less than 50 workers and as large ones those employing 500-1,000 workers.

The employment criterion however can be applied only in those cases where the number of employed defines the size of the plant. In some cases the size of the industrial plant is decided not by the number of workers but by the power of the installed equipment, by the manufacturing capacity, etc. Furthermore one should also bear in mind that in various branches of industry the significance of the employment criterion varies. For example, a mine employing 200 people is a small mine, whereas a power plant or gas works employing that number is a large one. The grouping of industrial plants according to size cannot therefore be based entirely on one criterion in all cases. In specific branches of industry, plants are grouped according to varying criteria, for example, the amount of production (quantity of mined coal), value of production, value of permanent means, power capacity, etc.

Statistics in prewar Poland used a division of industry into large, medium, and small based on the category of the industrial certificate purchased by the plant from the treasury.

Large industry comprised plants having certificates of categories I-III, medium industry categories IV and V, and small industries comprised those plants having certificates of categories VI, VII, and VIII.

The category of an industrial certificate depended upon the volume of production in coal and ore mines, oil fields, distilleries, breweries, sugar refineries, etc, the sum of the diameters of mill stones in mills, on the number of active presses in creameries, and on the number of employed workers in other plants.

As a result of this division the employee average in a large industrial plant amounted to over 200 workers, in a small industries plant up to 15 workers (from 1935 up to 25 workers).

At present in Polish statistics and planning the division into large, medium, and small industries is made according to the departmental affiliation as discussed in Paragraph II of this chapter.

III. STATISTICS OF INDUSTRIAL PRODUCTION

J. Kantor

1. Concept of Industrial Production

Statistical studies of industrial production are among the most important tasks of industrial statistics. The production of industrial articles is the main task of industrial plants.

By industrial production is understood the direct and useful result of the productive work of the industrial plant in the form of industrial articles and services (works).

According to this new definition the production of a plant comprises only that which is produced in the given plant and possesses utilitarian value.

The production of a plant would not include such results of creative work which do not have utilitarian value. Hence the production of a plant would not include deficient articles of any kind (rejects). That means articles which cannot be used according to their designation, since they do not meet required specifications.

Neither can one include in the production cf a given plant the production from raw materials belonging to the plant but manufactured in another plant as a result of the spreading (feeding) system. Let us take an example. Let us assume that plant "A" turns yarn over to plant "B" for weaving. The produced cloth is returned to plant "A" and plant "B" receives remuneration in exchange. Even though the cloth belongs to plant "A," it cannot include it as its own production since it is not the result of its own labor. On the other hand, plant "B" should include it as its production even though it was produced from yarn belonging to plant "A."

Accordingly industrial production should include all products manufactured in the plant regardless of the source of the raw materials used.

Speaking of the production of a defined article, we have in mind production from primary or raw material. It happens frequently that new articles are produced from wastes of basic articles, for example, insulation plates from wood shavings, toys from cloth cuttings or wood scrap, etc. Articles are also produced from used materials, for example, children's clothing from used adult clothing, used parts in the manufacture of new pianos, new boxes from used parts of old ones, etc. Such articles are also included in the production of a plant, since they are usable and they are the direct result of the labor of the plant. Production in a plant does not depend on the raw materials. Its determining factor is the creation of a new and useful article.

Industrial production also includes so-called by-products produced in conjunction with the basic product in the course of manufacture, (for example, in sugar production, molasses, in the making of coke, coking gas, as a by-product of sulfite in the production of cellulose, etc). Besides the above-mentioned products obtained as a result of the creative labor of the plant, industrial production includes productive services of an industrial nature. Here we first include the installation work done outside the plant by permanent plant personnel when its value was not included in the value of the installed product, for example, the installing of a boiler on the customer's premises by employees of the plant which produced the boiler is included in the production of the plant, if the installation cost was not included in the cost of the boiler. In this case, the installation should be considered as a final phase of production.

Services also include all repairs to industrial products as well as capital improvements to equipment, with the exception of construction works done in capital repairs of blast furnaces, industrial furnaces, kilns, gas-generating towers, etc, since these are large investment items, and like repairs to buildings, factory halls, etc, are classified as investments. Services also include labor invested not in production of new products from raw materials but in the division of products created in other plants or in the increase of their value by additional work effort, (for example, cutting of meats, bottling of beer, vinegar, wine, or edible oils, regeneration of filtration coal or oil, etc).

Under the heading of services are also included all kinds of profitable work of various plant departments, for example, machining and heat treatment, galvanizing and nickel plating on a jobbing basis, dyeing, finishing, treatment of fabrics, etc.

We see from the cited examples that productive services can be of 2 kinds, services whose task it is to maintain or restore the usefulness of a product by repair and services which increase the value of the finished goods, (galvanizing, nickel plating, dyeing, etc).

Industrial production includes finished articles, part articles (semiproducts), as well as unfinished production. The most important of these being articles ready for use.

GUS instructions concerning statistical reports on the fulfillment of technical, industrial, and financial plans explain the concept of "finished products," as "finished and complete articles which adhere strictly to accepted norms or to such technical conditions adopted by the technical control within the enterprise or established by the purchaser regardless of whether they are ear-marked for sale, for the capital improvement of the

machinery and equipment belonging to the enterprise, for economic investment, or for the factory itself or off the premises facilities."

The article then is considered finished, not merely when it is completely processed, but only after it has been accepted by the technical control of the factory and after the confirmation that it meets required specifications. The correct definition of the time that the article is finished is of great significance in statistical reporting, since in the report it is permissible to list under finished production only that part of production which was approved by the technical control within the report.

We can examine the concept of finished articles only from the standpoint of a given report unit (industrial plant or enterprise).

From this standpoint a finished article will be one that requires no further processing in the plant in which it was produced. On the other hand, an article that requires further processing in the factory of its origin should be considered a semiproduct (partly fabricated).

In a textile mill, for example, yarn spun in the spinning department but still to be woven in the weaving department of the same mill into fabricsis a semiproduct. In a winery the semiproducts are fruit juice, purees, and pulp from which wine is obtained as the final product of the same establishment.

In an iron foundry semiproducts are in the order of processing: (a) pig iron processed in the foundry's steel mills into raw steel; and (b) raw steel processed in the foundry's rolling mills into rolling stock, etc.

Not all articles are uniform like hard coal, bricks, cement, coke, etc. In many cases the article is composed of a series of parts, for example, a table of a frame, drawer, and top, boots of an upper, insole, sole, and heel, a bicycle of wheels (and the wheels are composed of rims, spokes, axle, tires, and inner tube), frame, fork, handle bars, seat, hubs, chain, etc. Other articles are made up of several and even several hundreds of parts which are produced in specific departments of an industrial plant.

It happens quite frequently however that not all parts and semiproducts are assembled or processed into finished atricles, but are disposed of outside of the premises in which they are produced, (for example, a bicycle factory disposes of not only complete bicycles but also specific parts, such as hubs, axles, rims, frames, etc). Since these parts or semiproducts are intended for sale and not for further processing, they should be included in the finished production of the given plant (under finished articles).

Accordingly the GUS instructions include the following among finished products.

"a. Parts of products earmarked for sale regardless of their stage of completion.

b. Semiproducts provided they are sold outside of the enterprise or are earmarked for the enterprise's own economy investments, capital improvements, or other extra operational activity of the enterprise."

Not all parts can be used up in the completion of finished products within a given report period. Those parts not in service or remaining in stock in the various departments constitute unfinished production.

It should be emphasized that unfinished production comprises not only parts of unfinished finished products but also those articles remaining in the workshop, for example, on machine tools, on weaving looms, etc.

Under the heading of unfinished production comes all the production of a plant which at the time of the report is still in the course of manufacture, hence, parts and materials in the process of manufacture or assembly, or parts, materials, or semiproducts found in departmental store rooms or at the various work posts awaiting further processing, alteration, or assembling.

Unfinished production also includes products ready for use which require final completion with parts produced by the same plant or purchased from other plants. In a bicycle factory, for example, unfinished production will include fully assembled bicycles which lack tires (the fault, let us say, of the tire factory which did not supply them on time, as a result of which the bicycles could not be completed).

2. Quantity of Production

In defining the magnitude of production in natural units each product is given in the units of measure appropriate to its physical characteristics and designation. Hence, electrical energy in kwh (kilowatt hours), hard coal, in t, illuminating gas in cu m, shoes in pairs, locomotives in pieces, etc.

Quantity computation of production of one kind does not present any difficulties. Difficulties arise in the counting of heterogeneous products with a large number of assortments. In some branches of industry the number of assortments is enormous, amounting to tens of thousands. The computation of such an assorted production at a central level (GUS, ministry or central administration of industry) is therefore impossible and

pointless, impossible, because statistical presentations would require such a tremendous apparatus that no government could afford it in view of the prohibitive cost, pointless, because orientation in the tremendous mass of figures would be difficult.

Furthermore were we to leave to the plants the decision of the names and units of measure of the products, we would receive noncomparative material, which does not lend itself to statistical presentation, since the same product manufactured in several plants would be listed under different names or under names which might sound alike but mean several things. The product would be given in various units of measure, for example, electric engines in pieces, motors in kg, etc, and in the latter it would not be known whether they are electric motors (electric engines), gas motors (gas engines), or internal combustion motors (internal combustion engines).

Data submitted in this manner would be impossible to summarize or to obtain from them the proper figures which would illustrate the magnitude of the given product.

An unclear nomenclature of products can further cause error by including products in the wrong group, a thing that would be difficult to check and correct.

In order to avoid such difficulties, a so-called "statistical statement of products" is used in statistical studies. It lists uniform names for products and their units of measure as well as a classification of the product. All industrial products are divided into branches and each branch in turn into smaller groups, such as divisions, groups, subgroups, etc.

The problem of classification of industrial products is discussed in detail in the chapter on statistical supplies.

There sometimes arises the necessity of expressing in one measure of production products fundamentally different, but which are similar either in construction or utilization. In such cases computation is done in arbitrary units, that is heterogeneous production is expressed in a unit of measure agreed upon. Examples are artificial fertilizer factories producing fertilizers of a varying content of phosphorus or nitrogen, factories which produce sulfuric acid of varying concentrations, distilleries producing alcohol of varying strengths, railroad yards producing cars of varying size, etc.

These products, heterogeneous in certain respects, are entered under a common unit of measure, which properly describes the magnitude of production of the given product. For example, artificial fertilizers are computed according to the contents of the pure component (for example, superphosphate in P_2O_5), sulfuric acid of varying concentration in 100%, alcohol of varying strength in 100^{o}, railroad cars of various sizes in 2-axle cars, fuels of all kinds of varying calorific value in fuel of an arbitrary value of 7,000 cal, etc. One can cite a whole series of examples for the computing of production in arbitrary units where the basis of computation is the utilitarian value of a given product.

Another method of computing production in arbitrary units is computation on the basis of labor input necessary to provide one unit of the product in accordance with binding norms.

The technique of computation is very simple and depends on the computation of the labor output coefficient per unit of a given kind of product, accepting the norm labor output for product A as 1, and multi-

plying the number of produced products by the corresponding coefficient. The result of this computation is presented in the last column of the table, the sum of all the figures of this column gives the overall magnitude of production of products A, B, and C expressed in the unit of production of A.

In computing production in arbitrary units as a basis of computation, we can also select other elements, for example, the manufacturing cost of the product.

Example. (Sawinski, D. W., Kurs promyszlennoj statistiki [Course on Industrial Statistics] (Russian edition, 1949, Moscow, page 82):

Products	Units produced	Time norm per unit in man-hours	Ratio of Work Output to time norm per unit taken as a basis	Production computed per arbitrary unit
A	1,000	10	1.0	1,000
B	2,000	20	2.0	4,000
C	3,000	5	0.5	1,500
Total computed for product A	X	X	X	6,500

The computation in arbitrary units discussed above can be applied only in definite cases where only products of one kind enter the computation.

A quantitative (in physical units) grasp of production has a fundamental significance in the drawing up of a production balance sheet. On the basis of the production balance sheet is worked out the materials balance sheet which enables the correct coupling of the material for a given kind of production with the sources of its supply.

A production balance sheet of a plant is comprised of 2 parts, (a) income and (b) expenditures.

The income part is comprised of production supplies at the beginning of the report period and the production accomplished in this period.

The expenditure side includes the plant expenditures for production, savings and investment purposes, purchases outside of the plant, losses, and the remaining production elements in the plant at the end of the report period.

On a national scale a production balance sheet also includes, on the credit side, the import of materials and, on the debit side, industrial and investment costs, market supplies serving to insure the individual needs of the population, export, and increase in state stocks and reserves.

3. Value of Production

The quantitative grasp of production allows us to compute the magnitude of production of specific products in strictly defined units of measure. It does not however, permit the definition of the entire magnitude of production by the introduction of one common denominator. For this reason, in addition to the quantitative magnitude of production, industrial statistics study at the same time the magnitude of production according to value.

In statistical reporting in computing the value of production, factory wholesale prices (market prices), f. o. b. factory, are applied.

Besides current prices, statistical reporting also uses fixed prices, since in analyzing the physical extent of production one cannot compare the magnitude of production computed according to current prices in 2

different periods, because the prices of the period studied invariably differ from the prices of the preceding period.

Let us clarify this with an example. Let us assume that a cement factory during its first year produced 10,000 t of cement and that the price of one t was 20 zlotys. That means that the production of cement computed in current prices amounted to 200,000 zlotys. In the second year 12,000 t were produced at a price of 18 zlotys per t (lower price of cement). Hence the production value of cement in the second year amounted to 216,000 zlotys.

The quantitative growth of cement production was $\frac{2000}{10,000} \cdot 100 =$ 20%.

Examining the dynamics of production according to value in current prices, we see that the growth of production was 8% $\frac{216,000}{200,000} \cdot 100 = 108$). Hence, the growth in production according to value in current prices is 12% lower than the actual growth in the quantitative sense, which is explained by a 10% lowering of cement prices.

The application of current prices in the computation of the index of the physical magnitude of production is possible only if the computations are corrected for the price index.

In our case the price index is $\frac{18}{20} = 0.9$.

Correcting the magnitude of production for the price index we obtain $\frac{216,000}{0.9} = 240,000$, hence the index for the physical dynamics of production is $\frac{240,000}{200,000} \cdot 100 = 120$.

In practice, in the studies of the dynamics of the physical magnitude of production fixed prices are applied according to which the value of production of the reporting and basic period are computed.

In all value production computations in plans as well as statistical reporting immediately after the war and in the Three-Year Plan, 1937 prices were adopted as the fixed price, because GUS possessed detailed data concerning production value for that year, and because the greatest number of catalogues of prices of industrial articles for that period were preserved.

The application of 1937 prices however had basic faults. These prices contained a series of financial elements inherent in the market prices resulting from the peculiar market situation arising from the monopolizing of a series of production branches (prices of monopoly products of the prewar period are of little use as a gauge in the computation of production volume).

The 1937 prices did not include many articles which were not produced in pre-September Poland but were produced in People's Poland.

Furthermore the composition of the 1937 prices did not correspond to factual interrelationships existing between prices in various economic branches of People's Poland. This mainly concerned industrial and agricultural production. The reform of the system of fixed prices based on those of 1937 was introduced by a resolution of 15 March 1949 of the economic committee of the Council of Ministers.

As a basis the fundamental fixed prices in effect in 1948 were accepted, based on the average effective prices received in 1937 by producers from wholesale sales without exercise taxes, f. o. b. mill (f. o. b. car loading station).

On the basis of this resolution was compiled a "catalogue of fixed prices" which introduced the new system of fixed prices in effect since 1950.

We submit an excerpt from the "Catalogue of Fixed Prices."

Serial No	Number GUS statistical	Of article	Group division	Name of Article	Weight	Width	Unit of measure	Unit price
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
				Silk and outfitting industry				
1	090222	101	1/1	Men's underwear	80	95	1 rm	2.65
2	090222	103	1/1	Men's underwear	80	95	same	2.90
3	090222	107	1/2	Men's underwear	80	70	same	1.95
4	090223	109	11/1	Lightweight lining	80	99	same	2.30
5	090243	112	11/1	Heavyweight lining	90	196	same	2.95
6	090243	113	11/2	"Minerva" lining	140	235	same	4.50
7	090221	115/90	111/1	Pique blouse [material]	90	138	same	3.55
8	090221	116	111/1	Pique Blouse [material]	80	123	same	3.25
9	090221	117	IV/1	Dress crepe "Mongol"	90	87	same	3.05
10	090221	118	IV/1	Dress crepe marocain	90	100	same	3.10
11	090221	121	IV/2	Dress crepe "Mouse"	90	120	same	4.50
12	090221	122	IV/2	Dress crepe satin	90	162	same	4.15
13	090221	123	IV/1	Dress crepe bark	90	92	same	2.90
14	090221	130	IV/1	Dress crepe bemberg	90	78	same	4.35
15	090221	131	IV/2	Dress crepe "antelope"	90	168	same	5.10
16	090221	132	IV/2	Dress crepe "antelope"	90	165	same	4.85
17	090221	133	III/1	Blouse	90	107	same	3.20

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
18	090221	134	III/1	Blouse	90	99	same	3.65
19	090221	138	IV/3	Dress Jacquard	90	140	same	5.70
20	090223	141	IV/3	Corset Jacquard	70	112	same	4.20
21	090223	142	VII/1	Colored Damask	80	124	same	5.00
22	090224	143	VIII/1	Cravat	90	175	same	4.50
23	090244	146	VIII/2	Striped cravat	90	140	same	4.90
24	090185	148	VIII/3	Cravat	83	120	same	45.00
25	090224	151	IX/1	Umbrella	48 x 2	91	same	7.60
26	090185	152	X/1	Shawl	100	20	same	15.00
27	090185	153	X/1	Ladies shawl	90	70	same	45.00
28	090327	155	X/1	Men's "Argon" shawl	32 x 120	95	pieces	1.85

A great disadvantage of fixed price is their insufficient differentiation. It is understandable that this lack leads to a certain distortion of value measure computed from them. Furthermore fixed prices are computed for products already produced and do not include new products. Fixed prices for new products are estimated by individual enterprises. The principles for the computing of fixed prices in such cases will be discussed later.

Despite the faults we have pointed out, fixed prices have a basic significance in studies concerning magnitude and dynamics of production.

In the Soviet Union in the first years of the Great October Socialist Revolution the prices of 1912 (for some articles of 1911 and 1913) were adopted as fixed prices.

This selection was motivated by the fact that statistics had at its disposal a wealth of price material for a variety of products for that year. This material was accumulated in the course of last prewar industrial listing conducted in 1913.

The 1912 prices however did not comprise all products and were not clearly defined as to their kind or grade. Furthermore their fundamental fault was the fact that they expressed relationships existing in the prerevolutionary period between prices of various products. 1912 prices were replaced in 1927-1928 by prices of 1926-1927.

The essential difference between the fixed prices of 1927-1928 and 1912 was that they concerned socialized industry and that they were individual prices, that is, prices according to which each enterprise sold its products.

Computations on the basis of 1926 and 1927 individual prices did not give the proper evaluation of the magnitude of production, since each enterprise applied various prices for similar articles.

In 1936 individually fixed prices were in effect replaced by uniform average prices of 1926-1927 in the Soviet Union.

After World War II the resolution of the Council of Ministers of 26 July 1948 introduced the obligation to compute production according to the fixed prices of 1926-1927.

In the Five-Year Plan for the years 1951-1955, in accordance with a government resolution, wholesale prices of enterprises on 1 January 1952 were accepted for the computation of gross production.

Measures of Production Value

Gross Volume. As is known, an industrial enterprise is composed of a series of basic and auxiliary departments. The process of production passes through the departments in stages. As a result of the creative work of the various departments, semiproducts, finished articles, or production services are detained. The various stages of the production cycle can be best illustrated by the following example. Iron ore together with the requisite fluxes is submitted to a technical process in the blast furnace, from which it passes in the form of pig iron to the steel works, where it is converted in open hearth or other type furnaces into steel stock and is next transferred to a rolling mill or a forge whence it emerges in the form of ready for use production, as sheets or other rolled products.

Summarizing the value of production of all departments over a certain period of time as well as the difference between the value of works at the beginning, during and at the end of a reporting period, we obtain

the so-called gross volume. Gross volume is the sum of the value of production of the various departments of the enterprise.

In computing production in the above manner, items are included several times into the value of production, since an item processed in one department and considered a semiproduct in the total production process of the enterprise passes on to a different department for further processing, and its entire value is again included in the total value of production of the latter department.

As a result, gross volume does not give us the correct value of the final result of the production process of the enterprise. It merely characterizes the scope of production of all the departments of the given enterprise when treated individually and reflects all structural changes of the industrial plant. The change in the magnitude of the gross volume corresponds to the change in the number of productive departments of the enterprise.

Let us take as an example a cement works consisting of the following productive departments: (a) limestone quarry, (b) kilns (for the burning of the clinker), and (c) mills (for the grinding of the clinker into cement).

Let us assume the value of materials produced by the quarry amounts to 1.5 million zlotys, of the clinker to 2 million zlotys, cement to 2.2 million zlotys. Hence the gross volume of the entire enterprise for the report period amounts to 5.7 million zlotys. Let us assume now that during the next reporting period the limestone quarry separated from the cement works into an independent enterprise, and the production of limestone during that period amounted to 1.7 million zlotys.

This limestone was purchased by the cement works for the production of cement. The value of production of the remaining departments of the cement works was 2.5 million zlotys for kilns and 2.7 million zlotys for mills. The gross volume of the cement works during the second report period amounted 5.2 million zlotys. Hence, despite the increase in production of the individual departments, the gross volume decreased as a result of the separation of the quarry.

In current statistical reporting, the value of production is not computed by the gross volume method.

Gross Production. Gross production is the value of the final result of the production process of a given enterprise during the period under study.

In computing gross production, unlike the computations for gross volume, the inclusion of the value of the products within the scope of the same enterprise does not enter more than once, since that part of the semiproducts which is to undergo further processing is not included at all in the gross production. (In gross production are included only the so-called typical semiproducts which we will discuss later.)

We will present this in an example.

Serial No	Products	Gross volume	Value of production used up in further processing within the enterprise in 1,000 zlotys	Gross value of production
1	2	3	4	5
1	Limestone	1,500	1,300	200
2	Clinker	2,000	1,900	100
3	Portland cement	2,200	--	2,200
Total		5,700	3,200	2,500

The above presentation illustrates the difference between gross volume and gross production. Gross volume is the sum of column 3, that is, 5,700 zlotys, Hence it represents the sum of production of the individual departments of the cement works, the limestone quarry (basic raw material), kiln, and mills in which the clinker is ground into the finished product, namely cement.

Column 5 shows the gross production, that is, the value of the final product, in this case, cement and the value of that part of the semiproducts which were not processed in the enterprise proper.

If we designate the gross volume as G_1, gross production as G_3, and the production used up for further processing in the enterprise (or the so-called intraplant volume) as G_2, the formula for computing the gross production will be

$$G_3 = G_1 - G_2.$$

In practice, the intraplant volume includes semiproducts and parts of items produced not only during report period but also in prior periods. The question arises if the semiproducts of prior periods should not be subtracted from the gross production.

This will be explained by the following example.

Serial No	Products	Gross volume	Processed			Left unprocessed from production of report period	Processed out of unfinished in prior periods	Difference of remaining semi-products	Value of gross production
			Total	Of that from production of report period	Of that from production of prior periods				
1	2	3	4	5	6	7	8	9	10
1	Limestone	1,500	1,400	1,300	100	200	100	+100	+100
2	Clinker	2,000	2,200	1,900	300	100	300	-200	-200
3	Portland cement	2,200	--	--	--	--	--	--	2,200
Total		5,700	3,600	3,200	400	300	400	-100	2,100

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In accordance with the equation given above $G_3 = G_1 - G_2$, we subtract from the gross volume (5.7 million slotys) the intraplant volume (3.6 million zlotys) and obtain the gross production (2.1 million zlotys). As we see, the value of gross production os lower by 100,000 zlotys from the value of ready for use products (cement), since we followed the rule of including in the value of gross production the value of the financial product (Portland cement), namely 2.2 million zlotys, the value of the unprocessed portion of limestone, namely 200,000 zlotys, the value of the clinker, namely 100,000 zlotys, and subtracted from it the value of limestone, namely 100,000 zlotys, and the value of clinker, namely 300,000 zlotys, since the value of these semiproducts was already included in the gross production of the prior periods, and during the period under report the enterprise did not expend any labor on the production of these semiproducts.

It results from the above that one should include in the gross production the difference of the remaining unfinished production inventories.

In practically every branch of industry there is production unfinished during a report period. In the majority of branches, the remains of unfinished production vary slightly at the beginning and at the end of a report period. In such cases, the unfinished production is more or less constant in value, and its inclusion in the computation is not essential.

However, in such branches as machine building and construction, shipbuilding, electrotechnical (in the field of machine building) industries, where the production cycle of many produced items lasts several months, unfinished production must be taken into account.

If in branches of industry involving long production cycles the value of gross production were to include only the value of finished products, then in some months it would be impossible to show any gross production whatsoever, and in the months in which the production of items of a long production cycle was finished the value of gross production would not correspond to the actual labor output in these months.

It would also be an error to include in the gross production of a given report period the total value of unfinished production, since all preceding reporting periods constitute links in the chain of this production, because the unfinished production created in the prior report periods would again be included in the total of the gross production of the given report period.

This will be best explained by the following example.

Plants	Value of finished products	Value of Unfinished Production			Value of gross production
		Beginning of report period	End of report period	Increase or decrease of unfinished production	
			in 1,000 zlotys		
1	2	3	4	5	6
Plant A	5,000	400	600	+200	5,200
Plant B	5,000	600	450	-150	4,850
Plant C	5,000	400	400	0	5,000

In this example we listed 3 plants where the value of ready for use products during the report period was the same.

Plant A increased the production by 200,000 zlotys over and above the finished products, because it started on unfinished production, Plant B increased the production of finished products at the expense

of unfinished production in the preceding period, and the results of its activity during the period under report are lower than for Plant A.

Plant C worked evenly, since the unfinished production in the beginning and the end of the reporting period were the same.

In order to avoid duplication of the same production by adding it to several consecutive periods, it is necessary to subtract from the finished products the unfinished production as it appeared in the beginning of the reporting period and to add to it that of the close of the reporting period. In other words it is necessary to add (or subtract) to the ready for use products the difference in the unfinished production inventories.

There are various methods of compiling the value of unfinished production. The following are most frequently used: (1) Inventory, (2) work progress (operational) cards, (3) average, based on bookkeeping data, and (4) flow of norm-hours.

The most accurate is the inventory system or the so-called direct method which involves the computation of each part of unfinished production according to a price list, provided it embraces prices for all individual parts which comprise unfinished production.

In view of the large output of labor in computing the value of all the parts on the basis of an inventory, it is applied primarily for the compilation of the yearly balance sheet.

The second method for the computation of the value of unfinished production is based on the so-called system of job (operational) cards at the plant. Each product has its job card which the worker receives together with the material earmarked for processing. Entered on this job card is the

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time consumed and the kind of work done on the article. After the compilation of the given type of processing at one operational stage, the card together with the article are moved to a second work post. This is repeated until the processing of the article is completed.

At the end of the reporting period the value of the unfinished production is computed on the basis of the job (operational) cards.

In enterprises processing a large variety of articles the maintenance of job cards is difficult, and such compilation is impossible in practice since the final processing of all parts cannot be finished simultaneously.

Another method of compilation, the so-called "average" is based on bookkeeping expenditure data.

The value of unfinished production is established on the basis of the percentage readiness of the product using the value of the finished article as a starting point.

If we designate the value of the entire production of a given product with a long production cycle with P, the length of the production cycle in days with T, the number of work days expended for production up to the time of computation with T_i, then the expenditure for one production day of the ready for use article is $\frac{P}{T}$ and the value of unfinished production for a given period will be $\frac{P}{T} \cdot T_i$. Let us assume that the value of production of the given product with a long production cycle to be 1.5 million zlotys and the length of the production cycle to be 75 days. Then the one day production value will amount to $\frac{1,500,000}{75} = 20,000$ zlotys, and the value of unfinished production for a given report period of, let us say, one month (25 work days) will amount to 20,000 zlotys times 25 work days = 500,000 zlotys.

Attention should be called to the fact that production costs are not distributed equally for each work day, but increase gradually from 0 at the moment the production cycle starts to one, that is, to its full magnitude at the time the article leaves the factory. In this connection it is necessary to introduce a correction in the computation of unfinished production, which takes into account the tempo of increasing production costs. This correction is introduced by means of the increasing cost coefficient. The increasing cost coefficient varies for different kinds of production. It depends on the structure of production costs and on the technical process in individual cases.

In making computations it is necessary first of all to establish the increasing cost coefficient for each kind of outlay.

In our example we accept the coefficient for raw and other materials as equal to one, starting out with the assumption that they enter the production process in their entirety from the very beginning. For other costs (electrical power, wages, departmental, and factory expenses) we accept the coefficient of increasing costs as 0.50 (arithmetic mean of the uniform increase in costs from 0 to one).

In order to establish the overall coefficient of increasing production costs, it is necessary to multiply the coefficient obtained for each kind of outlay by the percentage expressing the proportion of this given outlay in the total cost of production. Let us assume that in our example the total value of materials fully used in the production constitutes 65% of the production cost, the value of electric power constitutes 1.5%, wages 8%, and overall departmental and factory expenses 25.5%, and let us assume that they increase uniformly for the duration of the entire production cycle.

The overall coefficient of increasing production costs is then as follows.

1.	Raw and other materials	1.00 x 0.650 = 0.6500
2.	Electrical power	0.50 x 0.015 = 0.0075
3.	Wages	0.50 x 0.080 = 0.0400
4.	Other departmental and factory expenses	0.50 x 0.255 = 0.1275
	Total	1.000 0.8250

In the above given example the value of unfinished production amounts to 500,000 zlotys. We correct this figure by means of the obtained coefficient of increasing costs expressed by the figure 0.8250. After taking into account the correction for the coefficient of increasing costs, the value of unfinished production will amount to 500,000 x 0.8250 = 412,500 zlotys. The computation is done according to the equation

$$\frac{P}{T} \times T_1 = W,$$

where W is the coefficient of increasing costs.

It is necessary however to note that it is not always possible to compute exactly the coefficient of increasing costs. First the method for computing the time of duration of the production cycle is not always exact, since there is usually a lack of criteria to permit the establishment of the time consumed on organizational activity during the cycle (particularly in computing cycles in the case of a given assortment of products). Second there is a certain inaccuracy in the establishment of the degree of completion of production. The coefficient of increasing costs is established arbitrarily, mainly as 0.50 (arithmetic mean of uniformly increasing costs between 0 and one), whereas in reality it depends upon the degree with which work outlays increase in the duration of the production cycle in specific departments of the plant.

Essentially only the production work output can be established according to the production cycle, since it starts and ends with the production cycle. Raw and other materials on the other hand are supplied to the production branches before the beginning of the cycle, most frequently all at once for the entire production lot, and bookkeeping computations do not take into account the actual state of supplies in auxiliary storerooms and the true date of their use. Bookkeeping is conducted according to the date of issue of the materials from the storeroom to the production branches and not according to the date of their use in the course of production.

In some cases unfinished production is computed on the basis of the "passage of the value of norm-hours," that is, the quantity of norm-hours worked multiplied by their value. The value of the norm-hour is computed for each product on the basis of the quotient of the value of the product by the quantity of norm-hours necessary to produce it.

If, for example, the value of a finishing machine A amounts to 20,000 zlotys, and the planned quantity of norm-hours necessary to produce one unit of finishing machine A is 2,000 hours, then the value of one norm-hour will be:

$$tn = \frac{P}{T_n} = \frac{20,000}{2,000} = 10 \text{ zlotys}$$

tn signifying the value of one norm-hour,

P the value of one unit of the product, and

T_n the number of norm-hours necessary to produce one unit of the product.

Let us assume that in the period under report 580 man-hours were put into the production of the finishing machine. The magnitude of unfinished production in this case will amount to

580 man-hours times 10 zlotys = 5,800 zlotys.

The compulsory monthly statistical report regarding the production quota fulfillment in heavy and medium industry comprises the following data concerning the gross production value.

(a) The value of finished articles, semiproducts, and parts produced by the basic, auxiliary, and other departments of the plant, from their own and entrusted raw material, together with the value of electrical power, steam, gas, compressed air, tools, equipment, casts, etc earmarked for sale, for capital repairs of their own buildings, equipment and machinery, for economic investments, for the plants housing and auxiliary farm needs or other nonproductive factory needs;

(b) The value of packaging materials unless included in the cost.

(c) The value of industrial services (of a material production character).

(d) The value of inventory differences for unfinished production and for tools and supplies of production.

In some branches of industry, gross production includes the value of typical semiproducts earmarked for further processing in the plant, such as the following.

1. Electrical power in all enterprises.

2. Refractory materials, metallurgic and electrolytic zinc in smelting and metallic industry enterprises.

3. Coke in enterprises of metallurgy, coke-chemistry, gas-engineering and petroleum, as well as semicoke in enterprises of the chemical industry.

4. Nonferrous metal ores in enterprises of the nonferrous metals industry.

5. Ores as chemical raw materials, sulfuric acid and phenol in enterprises of the chemical industry.

6. Coal, petroleum, peat extracted and used by the enterprise as fuel.

7. Peat designated for processing to enterprises for the processing of peat.

8. Boards in the enterprises of the lumber industry.

9. Emery and cellulose in cellulose-paper enterprises.

10. Yarn in the enterprises of the textile industry.

11. Tanned hides in tanning and footwear enterprises.

12. Meat slaughtered on the premises earmarked for smoking and canning in the enterprises of the meat industry.

13. Raw vegetable oils, solidified and refined in enterprises of the fats industry,

14. Caster sugar processed into refined.

15. Raw alcohol.

16. Juices and musts for the production of wines.

17. Malt in breweries.

18. Pulps in fruit and wine enterprises.

19. Fish caught by enterprise employees processed into fish products (in fishery enterprises).

The inclusion of typical semiproducts into gross production is dictated by their basic significance in a given branch of industry and in the material balances of the entire national economy. Were we to omit, for example, the production of coke used for the plants' needs in metallurgical plants, it would be impossible to establish the full extent of production of coke which is basic material in our material economy.

Not included in gross production is the value of the following.

(a) Waste materials of production, which comprise remnants of processed raw materials or which were created during production, for example, sawdust in a saw mill, shavings in metal processing plants, textile clippings in garment shops, etc.

(b) Rejects, that is, products which cannot be used as designated since they do not come up to norm or meet technical specifications, for example, a hide burned in tanning, badly printed cloth (with white stains etc).

(c) Transportation services.

(d) Services nonproductive in nature.

According to binding regulations gross production is computed by the so-called plant method, that is, that at all organizational levels of the industry gross production is computed by the addition of the gross production of the individual plants.

Gross production can also be computed by the method of the trust, of the central administration, branch of industry, or of the entire national economy.

When desiring to compute gross production by the method of the trust, central administration, or branch of industry, it is necessary to deduct from the gross volume of these organizational units the value of semiproducts processed within the scope of the various enterprises, trusts, central administrations, etc.

The final results of the production of the trust, central administration, industry, or branch of industry will express the gross production at a given organizational level.

We give below an example of computing gross production by the methods discussed above taken from the Soviet works of A. J. Jezow, Podrecznik statystyki przemyslowej [Manual of Industrial Statistics] (Table 2/III).

TABLE 2/III

					Value of processed semiproducts (in 1,000 rubles)					Gross production (in 1,000 rubles) computed by one of the described methods				
Branches of Industry	Trusts	Factories	Kind of Products	Executed (in 1,000 rubles) gross volume	Production of enterprises	Production of trust factories	Production of other trust	Production of factories of other branches	Production of the Enterprises of the farm economy	Factories (columns 5-6)	Trusts (columns 11-7 or columns 5-6-7)	Branches (columns 12-8 or columns 5-6-7-8)	Industry (columns 13-9 or columns 5-6-7-8-9)	National economy (columns 14-10)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
			a	1,000	700	300	--	--	--					
		1								2,300				
			b	2,000	--	--	--	300	1,000					
	I										2,600			
			d	500	300	--	--	--	100					
		2								800				
			c	600	--	200	100	--	100					
A												3,700		

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
			c	1,000	500	--	300	-	-					
		1								800				
			g	300	--	--	100	100	--					
	II		d	2,000	500	400	500	--	400		2,100			
		2								1,800				
			k	400	100	100	--	100	--					
													7,700	4,000
			f	600	--	200	--	100	100					
		1								1,600				
			g	1,500	500	400	--	--	300					
	I										2,100			
			f	1,000	--	300	200	200	--					
		2								1,400				
			h	500	100	--	100	--	200					
B												4,900		
			g	800	--	200	--	--	300					
		1								1,700				
			i	1,000	100	--	200	100	200					
	II										3,300			
		2	k	3,000	1,000	200	--	--	1,000	2,000				
Total				16,200	3,800	2,300	1,500	900	3,700	12,400	10,100	8,600	7,700	4,000

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Internal turnover of factory	3,800
Internal turnover of trust	6,100
Internal turnover of branch	7,600
Internal turnover of industry	8,500
Internal turnover of national economy	12,200

A. J. Jezow, Podrecznik statystyki przemyslowej, Ksiazka i Wiedza, 1950, page 50.

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MODEL 1/III

PART I. VALUE PRODUCTION FULFILLMENT AT CONSTANT PRICES IN 1,000 ZLOTYS

Serial No	Itemization	Plan for Report			Fulfillment				
		Year	Quarter	Month	in report month	same month 1954	from beginning of quarter, to the end of report month	from beginning of year, to the end of report month	same period 1954
1	2	3	4	5	6	7	8	9	10
1	Finished products								
2	Industrial services (works for self-use, investment, capital repairs, etc								
3	Industrial services (works) for outside orders								
4	Total (items 1-3)								
5	Of that, value of side production								
6	Inventory differential of setups, tools, and auxiliary materials for self-production**								
7	Inventory differential of semi-products (semifabrications) for self-production**								

1	2	3	4	5	6	7	8	9	10
8	Inventory differential of unfinished production**								
9	Raw material supplied by customer								
10	Typical semiproducts (semifabrications) used for further processing								
11	Total gross production (items 4+6 to 10)								

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MODEL 1/III

PART II. VALUE PRODUCTION FULFILLMENT AT PRESENT PRICES IN 1,000 ZLOTYS

Serial No	Itemization	Plan for Report: Year	Quarter	Month	Fulfillment: In report month	Same month 1954	From beginning of To the end of report month: Quarter	Year	Same period 1954
1	2	3	4	5	6	7	8	9	10
1	Finished products								
2	Industrial services (works) for self-use, investment capital, capital repairs, etc								
3	Industrial services (works) for outside orders								
4	Total commodity production at market prices (items 1-3)								
5	Of that, value of side production								
6	Inventory differential of set-ups, tools, and auxiliary materials for self-production**								
7	Inventory differential of semi-products (semifabrications) for self-production**								

1	2	3	4	5	6	7	8	9	10
8	Inventory differential of unfinished production**								
9	Raw material supplied by customer								
10	Typical semiproducts (semi-fabrications) used for further processing								
11	Total gross production (items 4+6 to 10)								

PART III. THE INFLUENCE OF PRICE CHANGE ON THE COMMODITY PRODUCTION OF AN ENTERPRISE AT MARKET PRICES IN 1,000 ZLOTYS*

Serial No	Itemization	Plan for Reporting			Fulfillment at marked prices established by plan			Fulfillment at actual prices obtained by enterprise		
		Year	Quarter	Month	In report month	From beginning of Quarter to end of report month	From beginning of Year to end of report month	In report month	From beginning of Quarter to end of report month	From beginning of Year to end of report month
1	2	3	4	5	6	7	8	9	10	11
1	Value of commodity production at selling price									

*Carried out to give one decimal point.

**Give increase with +, decrease with -.

<u>Commodity Production</u>. By commodity production is meant the value of production sold or earmarked for the market outside of the enterprise. It is that production which is designated for the supplying of various branches of the national economy and for consumption by the population.

In accordance with GUS instructions, commodity production includes the following.

(a) the value of finished products, parts, and semiproducts created by the basic, auxiliary, and other departments of the plant together with the value of electrical power, steam, water, gas, compressed air, tools and the various auxiliary materials earmarked for sale, for the needs of capital repairs of the plant's own buildings, equipment, and machinery, or for savings investments, for the plant's own housing economy and its auxiliary farm, as well as for other nonproductive needs of the enterprise.

(b) The value of industrial services of a material nature.

Commodity production does not include the value of semiproducts (semifabrications) processed in the plant, the value of the inventory differential of unfinished production, and the value of the inventory differential of facilities and equipment of self-production.

It includes not the full value of supplied raw materials but only the cost of their processing. (The supplied raw material is the property of the customer and not of the plant. The plant therefore did not expend any outlays for the purchase of these raw materials.)

The value of commodity production is computed at market prices by the plant method, just as is the gross production.

Computation of the value of commodity production at market prices has a basic significance for the national economy.

From the value of commodity production it is possible to establish the magnitude of the ready production which industry gave to Poland's national economy, the magnitude of production designated for consumption, for export, and for the supply of industry and investments.

Net production. Net production is the newly created value, which is a result of the industrial productive activity of the plant within a given report period. It is that part of the production which is the constituent element of the national income.

The value of net production is obtained by deducting from the value of gross production the carryover value, that is, the value of the used up means of production as follows.

(a) Materials used up in production, such as raw materials, semi-products from outside plants, and those typical semiproducts from the plant itseff which were processed in it, as well as the value of outside processing.

(b) Outside power, which insofar as used, increases production costs.

(c) Fuel, the plant's own materials for conservation and repairs, the cost of outside conservation and repairs, as well as of equipment and facilities, but only to the extent this increases production costs.

(d) Amortization value of buildings, machinery, technical facilities, etc, which were used up in the process of production.

(e) Other material costs which enter in the composition of production costs.

The difference then between gross production and the sum of the above listed materials and expenses constitutes net production.

Net production is computed on the basis of the total production of the plant.

Computations of the value of net production are done at current as well as at constant prices.

4. The Production Process

Production Systems.

Over and above the studies of the magnitude of industrial production, statistical studies also concern themselves with the problem of the production system. These systems have a direct effect on the size of production, productivity, and production costs. Therefore in analyzing quota fulfillments of industrial production it is necessary to take into account the production system used in a given enterprise.

We will discuss 3 basic production systems, namely (1) individual production, (2) serial production, and (3) mass production.

By individual production is meant the creation of various finished products in single units. For example, the plant produces a finishing machine to order from plans submitted by the customer. Such products may never be produced again, or perhaps repeated occasionally. In connection with this, the technical and productive facilities at the given plant are universal, and the kind of work at each work bench changes basically. The production process is fundamentally long and costly and productivity low, because of the frequent changes in the setup for each single part of the given subject, as a result of which a stoppage of the work results with each change of the setup. Workers employed in individual production must be highly qualified in view of the constant change in the type of work at a given work bench.

A second form of production, equally requiring high specialization, is serial production, that is, the production of items in series. The specific types (operations, problems) of work however are not as variable as in individual production. Conditions of serial production permit some specialization of the equipment.

We divide such production into large series and small series production, depending upon the number of units required.

Distinguished from individual and serial production is mass production, in which an important role is played by the normalization and setting up of the plant for the exclusive or predominant production of one product selected from a number of products which the plant is capable of producing. In mass production plants must limit themselves to several or at the most to less than 20 groups of products.

A characteristic trait of mass production is the continuity of the production process with the application of automatic or semiautomatic devices. Productive equipment is allotted according to the technical process assuring the minimum handling of the product, thus shortening the time necessary for its production. Each productive activity is divided into precisely defined operations.

The leading form of mass production is streamlined (continuous) production, which constitutes the most progressive form of organization of present-day production.

All productive facilities and work benches along the stream line are placed in the order of the production phases for the purpose of maintaining the motion of the processed articles from one operation to the next.

The work of all stream lines can assure an uninterrupted and uniform production of finished products only in the case where the activity of all work benches, together with the technical control and the transportation of parts, assemblies, and finished articles are strictly coordinated. In view of the significance of the application of progressive production systems, it is necessary to compute the percentage of participation of serial, mass, and streamline production in the total value of production. On the basis of the data of the part played by the various production systems in the total production of the enterprises (central administration), it is possible in turn to compute the dynamic indices of the production systems (serial, mass, streamline).

The statistical measure of streamline production is the rhythm of the stream, which we compute by dividing the time of production by the completed production according to the equation $R = \frac{T}{Q}$, where R signifies the rhythm of stream, T signifies the time put in, and Q signifies the completed production.

We compute the rhythm quota fulfillment by dividing the actual over the planned rhythm.

Production Cycle

By the concept, "production cycle," we understand the period of time which has passed from the starting moment of a given production process to the moment when the finished article appears. The duration of the production cycle depends on the kind of production as well as, to a greater or lesser degree, on the action of the conscious will of the human being (mobilization of workers to shorten the production cycle).

We differentiate 2 kinds of production cycles, (1) a cycle comprising the entire production process of a given finished product (for example,

the production cycle of an automobile, comprising all operations, starting with the production of the various automobile parts to the finishing, lacquering, and technical testing of the finished automobile); and (2) segmented production cycle, depending on a defined segment of the production process.

Equally the cycle comprising the entire production process as well as the segmented production cycle is composed of 2 parts: (a) actual working time, that is, the time in which the production process runs its course, and (b) stops, that is, intermissions resulting from the organization of work.

The duration time of the productive cycle can be computed according to the equation

$$T = t_1 + t_2 = t_3 + t_n,$$

where T is the duration of the full production cycle, and t is the time of segmented cycle.

$$t = R + P + P_1,$$

where R is the working time used per unit of the production element,

P is the time of the (prescribed) stop foreseen in the plan, and

P is the time of the stop not foreseen in the plan.

The percentage of fulfillment of the production cycle in relation to the plan is computed according to the equation

$$\frac{T}{T} = \frac{t_1+t_2+t_3+t_n}{T_o} = \frac{n(R+P+P_1)}{n(R_o+P_o)},$$

where n is the number of segmented cycles,

T_o is the duration of production cycle according to the plan,

R_o is the working time according to plan,

P_o is the prescribed stoppage period, and the other symbols are as above.

Let us assume that the planned duration of the production cycle of a finished article amounts to 1,520 man-hours, and stopping time foreseen in the plan is 60 man-hours. The entire production cycle consisted of 6 segmented cycles (For simplification the number is given as six. In reality there may be up to a hundred segmented cycles depending upon the complexity of the product) and the worked time amounted to the following in man-hours.

Segmented Cycle	Actual Working Time	Foreseen Stoppage Time	Unforseen Stoppage Time	Total Cycle Time
1	250	8	2	260
2	450	20	25	465
3	150	4	-	154
4	210	3	1	214
5	185	5	2	192
6	192	3	-	195
Total fulfill-ment	1,407	43	30	1,480
Total plan	1,460	60	-	1,520

The percentage of the plan fulfillment will amount to

$$\frac{1407+43+30}{1460+60} \times 100 = 97.3\%.$$

As is seen from the above example, the actual duration of the production cycle was shorter by 2.7% than the planned duration. This reduction caused by the shortening of the work time and the stoppage time as computed in the plan.

Rhythmicity of Production

Production plan fulfillment should run within a given calendar period strictly according to the charts, which constitute the basis for the rhythmical production of an industrial plant and for the uniform completion of production. There should be no place for the so-called production breaks, caused by irregular working conditions in the plant. Breaks in the utilization of technical setups and partial utilization of the productive capacity of a plant, increase losses and entail nonproductive expenses for overtime.

Rhythmicity of production is defined by the percentage of the monthly quota fulfillment by 10-day or daily periods during the month.

Let us assume that a plant produced 30,000 units during the month, 6,000 units during the first 10-day period, 10,000 during the second, and 14,000 units during the third.

The production fulfillment during the various 10-day periods in percentages of the total production amounts to 20% during the first, 33.3% during the second, and 46.7% during the third.

The above data indicate clearly the existence of production breaks in the plant.

A study of the rhythmicity of production can be made not only by 10-day periods, but also from monthly, quarterly, or yearly averages.

The harmonious, rhythmic productive operation of an industrial plant contributes to the achievement of a higher productive level and better quality of production, creates an atmosphere of peace and balance in the work of the crew, and enables the maximum utilization of the productive

capacity of the plant. Rhythmic operation creates conditions favorable to the avoidance of damage to productive equipment and excessive usage of means of production as well as of unexpected accidents and the ensuing unplanned repairs and enables the accomplishing of repairs as planned. Finally, rhythmic operation enables the uniform delivery of the ordered articles.

Reasons for breaks in rhythm vary. One of them is the sporadic delivery of or lack of supplies.

One way of studying the effect of supplies on the rhythm of production is presented in the following example.

Itemization		10-day Periods of the Month						Total for the month	
		Plan	Fulfill-ment	Plan	Fulfill-ment	Plan	Fulfill-ment	Plan	Fulfill-ment
1		2	3	4	5	6	7	8	9
Gross production value at unchanged prices in 1,000 zlotys		270	245	280	230	280	370	830	845
Plan fulfillment index		x	90.7	x	82.1	x	132.1	x	101.8
No of stoppage days due to lack of supplies		x	1	x	2	x	-	x	3
Loss in value of gross production in 1,000 zlotys		x	34	x	68	x	-	x	102
Ratio of unfulfilled to actual production during month		x	4.0	x	8.0	x	-		
Rhythmicity of production	a		29.0		28.5		42.5		
in percentages of total	b		+4.0		+8.0				
production	c	x	33.0		36.5				

a. Actually fulfilled

b. Not fulfilled because of lack of supplies.

c. Total a+b.

In this presentation we assumed that the value of daily production amounts to 34,000 zlotys at constant prices (daily average of the planned monthly production $\frac{\text{830,000 zlotys}}{\text{24 working days}}$). The total loss suffered therefore amounted to 102,000 zlotys during the first 10-day period, 34,000 zlotys as a result of a one-day stoppage, and 68,000 zlotys in the second 10-day period as a result of a 2-day stoppage. Had the supplies come in uniformly, there would have been no work stoppage, production during the first 10-day period would have reached 33.0% and in the second 36.5%, and the production break in the third 10-day period would not have had to occur.

5. Quality of Production

In addition to the magnitude of industrial production, the quality of production is of enormous significance, both in the production of consumer goods as well as in that of the means of production.

The study of the quality of production is conducted by the technical control organs which exist in each industrial enterprise. The task of technical control is not to permit an article of poor quality to be released for use.

One form of the study of the quality of production is the study of production grading. (The concept of grading production is applied in some industries, especially in mass consumption articles.)

The resolution of the committee of the Council of Ministers of 12 May 1950 regarding the quality of production (Monitor Polski, 10 June No A-65, 1950, position 765) lists the principles of grading articles by the

technical control of the enterprise into grades I, II, III, and IV [see Note] or defects according to the degree of their deviation from established norms or technical requirements. ([Note] It is necessary to differentiate between the grades of articles and the class to which an article belongs depending upon the raw material used to obtain it (for example, regardless of the kind of sawed tree).)

Statistics of grading has as its aim the study of achievements in the struggle to improve the quality of production, which increases with the systematic elemination of poorer grade products as well as the bringing to light of the reasons for poor quality of articles, as expressed by an increased portion of poor grade products.

We present below Model 2/III of the grading quota fulfillment for industrial production required in statistical reporting.

Name of Product	Unit of measure	Total production plan	Total production fulfillment	Grade I plan	Grade I fulfillment	% $\frac{\text{Column 5}}{\text{Column 3}} \times 100$	% $\frac{\text{Column 6}}{\text{Column 4}} \times 100$	Grade II plan	Grade II fulfillment
1	2	3	4	5	6	7	8	9	10
Total value of commodity production in 1,000 zlotys	a								
	b								
of that	a								
products	b								
	a								
	b								
	a								
	b								
	a								
	b								

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TABLE (continued)

Grade III		Grades IV and V		Remnants and other defects	%
plan	fulfillment	plan	fulfillment	fulfillment	$\frac{\text{Column 15}}{\text{Column 4}} \times 100$
11	12	13	14	15	16

a -- during report month

b -- from the beginning of the year to report period

Grading of production is defined by means of the so-called coefficient of mean grading. The coefficient of mean grading is the ratio of the quantity of the production of the various grades of a given article multiplied by the grade number to the total quantity of that article. The coefficient is computed from the following formula.

$$\frac{(1xa) + (2xb) + (3xc)}{a+b+c},$$

where the numeral 1 signifies grade I,

the numeral 2 signifies grade II,

the numeral 3 signifies grade III,

the letter a signifies the quantity of production of grade I,

the letter b signifies the quantity of production of grade II, and

the letter c signifies the quantity of production of grade III.

Let us assume that during the period under study 1,500 coats were produced, 750 grade I, 525 grade II, and 225 grade III. The coefficient of mean grading will amount to

$$\frac{(1x750) + (2x525) + (3x225)}{750+525+225} = \frac{2,475}{1,500} = 1.65$$

The coefficient of mean grading can also be computed in relative figures (percentages). For the above cited example, the computation in relative figures will be as follows.

$$\frac{(1x50.0) + (2x35.0) + (3x15.0)}{100} = \frac{165.0}{100} = 1.65.$$

The coefficient of mean grading vaccilates in the case of the 3 grades between 1.00 and 3.00, and the coefficient obtained for the production of grade I exclusively is 1.00, and grade II exclusively is 2.00.

This method of defining production grading does not however furnish detailed information on the improvement of quality production. Let us assume that during the report period production of grade I came down to 40% of the total production, grade II rose to 50%, and grade III production

to 10%. In this case the coefficient of mean grading will amount to

$$\frac{(1x40) + (2x50) + (3x10)}{100} = \frac{170}{100} = 1.7.$$

The coefficient of mean grading computed by the above method does not give any information as to the losses sustained as a result of the lowering of the quality of production, because it is computed on the basis of data regarding the various articles expressed in physical units.

Losses sustained as a result of the lowering of the quality of production are computed on the basis of the so-called general coefficient of mean grading, which is the percentage ratio of the average price, computed as a weighted average, to the price of grade I.

Coat Production		Price per Piece	Total Value
Grade	No of pieces	in zlotys	in 1,000 zlotys
I	750	1,000	750
II	525	800	420
III	225	600	135
Total	1,500	870	1,305

The general coefficient of mean grading:

$$\frac{870 \text{ (average weighted price)}}{1,000 \text{ (price of grade I)}} \times 100 = 87.0$$

In other words the general coefficient of mean grading is the percentage ration of the total value of production computed on the basis of the prices of the various grades to the value of production computed from the price of the grade I article.

$$\frac{1,305,000 \text{ zlotys}}{1,500 \text{ pieces times } 1,000 \text{ zlotys}} = 87.0\%.$$

This coefficient can be computed on the basis of absolute as well as relative production figures. In this case the percentage expressing the portion of production of a given grade is multiplied by the coefficient expressing the ration of the price of the article of that grade to the price of the grade I article accepted as equal to one.

For our example these data will appear as follows:

Grade	Production Fulfilled in %	Coefficient: Price of article over price of grade I article	Value of various grades of articles in percentages of the total production value in prices of grade I
I	50.0	1.0	50.0
II	35.0	0.8	28.00
III	15.0	0.6	9.00
Total	100.0	x	87.00

We present below an example of computing the coefficient of mean grading for the whole of the production in a case where the production comprises several articles, A, B, and C, and where the coefficient for each of them was established:

Name of article	Quantity of production	Price of grade I article	Production value at grade I prices in zlotys	Coefficient of mean grading	Actual Production value in zlotys
1	2	3	4	5	6
A	2,000	5	10,000	80	8,000
B	1,500	4	6,000	90	5,400
C	2,500	3	7,500	80	6,000
Total	x	x	23,500	x	19,400

Multiplying the price of grade I by the amount of produced articles and then by the coefficient of mean grading (divided by 100), we obtain the actual value of production.

The coefficient of mean grading for all articles amounts to

$$\frac{19,400}{23,500} \times 100 = 82.5\%$$

The index of production quality fulfillment in relation to the plan expresses the difference between the value of actual production of lower or higher quality and the value of the planned production.

Let us clarify this with the example below.

(See Example on Page 97)

In many industrial plants laboratory tests are being conducted on produced articles in order to establish the quality of production. Since the application of such a method to each individual mass produced article is physically impossible, tests are conducted on representative samples.

Another way to test the quality of production is to conduct an analysis of causes and frequency of reclamations made by recipients, as well as the establishing of losses resulting from refunds, price allowances, or exchanges of defective into full value products.

Quality of production is also evaluated on the basis of the percentage of defects (so-called defective production).

We differentiate 2 kinds of defects: (a) corrigible defects, and (b) final defects.

Grade of Article	Unit price in zlotys	Production				Maintaining the Various Grade percentages, production should have been as follows	
		Planned		Actual			
		No of pieces	percentage	No of pieces	Value in 1,000 zlotys	No of pieces	Value in 1,000 zlotys
1	2	3	4	5	6	7	8
I	200	2,000	50.0	1,800	360	2,100	420.00
II	150	1,500	37.5	1,700	255	1,575	236.25
III	100	500	12.5	700	70	525	52.50
Total	x	4,000	100	4,200	685	4,200	708.75

The loss in the given example amounts to 708,750 zlotys minus 685,000 zlotys = 23,750 zlotys, or the quality of production was lowered by 3.1%.

Corrigible defects is the defective production which can be brought up to required technical standards with the input of more labor.

Final defects is the defective production whose correction is technically impossible or economically not feasible.

Losses suffered by the enterprise as a result of corrigible defects equal the additional cost involved in their repair. On the other hand, losses sustained as a result of final defects are equal to the production cost of the defective production.

Besides the study of losses sustained by defective production, statistics are also used to study the etiology of defects.

Causes for defects may be divided into 3 fundamental groups: (1) use of second grade or improper raw materials, (2) inaccuracies in productive equipment, and (3) inaccuracies in operations performed by workers.

Analyzing defects by causes, statistics point out ways of avoiding them, indicate the necessity to use proper raw materials, to remove faulty productive equipment, or to give the workers additional training in order to raise their trade qualifications.

6. Variety of Production

In studying production quota fulfillment by quantity, it is necessary to take into account the plan fulfillment in conformity with established varieties.

This is indeed the case, since some enterprises, in their striving for a speedy and easy quota fulfillment, may produce excessive quantities

of articles which consume little labor, creating the effect of high value quota fulfillment. One can give as an example the production of iron screws. Were the variety of production not to be controlled, a plant might produce only screws of large diameter as easier to work and not produce fine screws which are relatively more time consuming.

In the Soviet Union, in addition to the quota fulfillment control in industrial plants, there is an evaluation of the plan fulfillment (so-called maintainance of the plan) by varieties.

In accordance with the method used there, the quota can be recognized as fulfilled only in the case where a plant produced all the articles according to the varieties submitted in the plan. (Sawinskiy, D. W., Kurs promyshlennoi statistiki (Russian edition), 1949, Moscow, pages 117-118).

In a case where a plant overfulfilled the quota production but did not fulfill it in one certain item listed in the plan, the plan is considered not fulfilled by variety. The production of articles not called for in the plan is not included in the fulfilled production, and the overfulfillment of the articles called for in the plan is listed merely as 100% fulfillment.

Example**

Name of Products	Plan	Actual Production	Considered as Plan fulfillment
A	1,400	1,500	1,400
B	800	700	700
C	2,800	3,000	2,800
D	-	300	-
E	-	200	-
Total	5,000	5,700	4,900

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**Example given from the work of D. W. Sawinskiy, Kurs promyshlennoi statistiki (Russian edition), 1949, Moscow, pages 117-118.

The plan fulfillment by variety is

$$\frac{4{,}900}{5{,}000} \times 100 = 98\%.$$

We give below another example illustrating a case, where a plant fulfilled all articles by variety as well as production not called for by the plan.

Name of Products	Plan	Actual Production	Considered as Plan fulfillment
A	1,400	1,500	1,500
B	800	800	800
C	2,800	3,000	3,000
D	-	300	300
E	-	200	200
	5,000	5,800	5,800

The plan fulfillment in this case is

$$\frac{5{,}800}{5{,}000} \times 100 = 116\%.$$

In computing fulfillment of production by variety, we use a so-called variety coefficient.

The variety coefficient is the ratio of the value of production created in accordance with the variety specified in the plan to the total planned production.

Example:

Kind of Product	Production at constant prices in 1,000 zlotys Planned	Actual	% of plan fulfill-ment	Possible Variety production in percentages of total fulfillment	Considered as plan fulfillment
1	2	3	4	5	6
A	100	50	50	120	50
B	100	50	50	120	50
C	50	100	200	60	60
D	-	50	-	-	-
E	-	50	-	-	-
Total	250	300	120	300	160

The plan fulfillment in this case is

$$\frac{160}{250} = 0.640.$$

The variety coefficient is computed by multiplying the planned production of the particular articles by the general percentage of plan fulfillment. Plan fulfillment (column 6) includes the planned articles, in quantity not exceeding the general percentage of plan fulfillment (column 4). In the uniform variety plan fulfillment the variety coefficient will equal one. The more the coefficient gets away from unity, the more the fulfillment deviates from the planned production.

7. Production Dynamics Index.

A basic task of industrial statistics is the study of the physical development of the magnitude of industrial production or the changes occurring in its volume. This study is conducted with the aid of the production dynamics index.

The industrial production dynamics index is the ratio of the magnitude of production in the studied period to the magnitude of production in a period taken as a basis, and the size of the basis production is defined in an even figure such as 1 or 100.

The formula for the dynamics index is

$$\frac{\sum q_1}{\sum q_o}$$

where q_1 is the size in the studied period and q_o during the basic period.

In cases where the sizes for which we are to obtain indices are of one kind, as for example, coal, steel, cement, sugar, etc, the computation of the index presents no difficulty. These are the so-called individual (simple) indices.

The dynamics index for black coal in 1953 (88.7 million t in ratio to black coal production in 1937 (36.2 million t), accepted as a base, appears as follows.

In computing the index for a series of articles or article groups for a branch of industry, or for the entire industry, the problem becomes complicated, since in such a case various articles must be compared which cannot be added even if they are measured by the same unit.

We know from prior discussions that in order to establish the magnitude of the entire production consisting of a sum of production volumes of various articles of different character, the finding of a common denominator which can be adopted for the measuring of all components regardless of their physical characteristics is essential. This common denominator of the size of production of the various articles is their value.

The industrial production dynamics index is based on the value of gross production.

The equation for the dynamics index appears as follows:

$$I = \frac{\sum q_1 p_o}{\sum q_o p_o},$$

where q_o is the quantity of production in the basic period,

q_1 is the quantity of production in the period under study, and

p_o is the constant price for a unit of production.

Production indices for specific years are computed on the basis of the full value of the gross production of the basic year (in our case 1937). Production indices for particular months are computed on the basis of the full value of gross production of the month under study (report month) in the ratio to the average monthly value of gross production for the basic year.

In order to eliminate the effects of batch production (sugar mill, starch plant, and farm distillery production) on the index of the monthly production volume, the index is computed without such production.

The dynamics index shown above can be computed only when we deal with statistical data concerning the full value of gross production. In a case where we only have data for the values of some industrial articles, we can compute only a representative industrial dynamics index, assuming arbitrarily that the dynamics index for all industrial production follows the same pattern as the dynamics index for these products. This assumption is correct only when the articles are representative enough, that is, when all branches of industry are represented by a proper selection and sufficient quantity of articles, a situation which is not always possible to attain. Even if the last condition is satisfied, the weakness of the representative index lies in the fact that it is based on an established listing

of products and does not reflect the development of production due to the manufacture of new articles.

For a number of years after World War II, GUS published aggregated representative industrial production dynamics indices, which included the following list of articles: coal, rock and extracted salt, cement, plate glass, raw steel, raw zinc, electrolytic and zinc dust, raw lead, locomotives, freight cars, tenders, passenger cars, petroleum, industrial sulfuric computed at 100% strength, artificial fertilizers, cotton, wool, bast fiber and artificial silk yarns, paper, cardboard, and hard sole leather.

Next, while already preparing to compute an index to include the full variety of production, a so-called expanded industrial dynamics index was published.

The expanded index comprised the following articles: black coal, coke, rock and extracted salt, construction lime, cement, bricks, porcelain, plate glass, pig iron, raw steel, raw zinc, electrolytical and zinc dust, raw lead, nails, iron and steel wire, farm machinery and equipment, finishing machines for the metals industry, standard gauge locomotives, freight cars, tenders and passenger cars, tractors, trucks, motorcycles, bicycles, electrical drilling machines, transformers for power distribution, cables, normal electric light bulbs, telephone instruments, petroleum, gasoline, industrial sulfuric acid computed at 100% strength, calcinated soda, caustic soda, carbide, artificial fertilizers, dyes, soap, matches, tarboard, cotton, woolen, linen, jute and artificial silk cloth, cellulose, paper, cardboard, hard sole leather, industrial and saddle leather, vegetable or mineral processed top leather, leather footwear on leather soles, boards, bentwood chairs, sugar (considered only for the yearly index), beer, malt, raw alcohol computed at 100° strength, bacon, meat and fish preserves, raw oils, oleomargarine, potato products, tobacco, cigars, filtertip and

nonfiltertip cigarettes, and electrical power.

The index of industrial production computed by GUS was based on the factual production of the above-mentioned articles in the given calendar month.

We show below the dynamics index of industrial production computed on the basis of the full value of gross production at constant prices and based on the production of the selected articles (included in the list of articles for the computation of the index in the period up to 1950).

We see from this presentation that the representative dynamics index showed great motion during the first year of the Three-Year Plan. This movement of the index was caused by the fact that it was formulated under the influence of coal and steel production, which were the dominating products in the list both as to quantity as well as value.

	Production	Index
Period	For articles included in list*	Gross**
	1	2
1937	100	100
1947	120.5	108.1
1948	152.8	153.3
1949	167.9	186.4
Months: I	161.4	160.7
II	154.4	158.1
III	169.1	182.1
IV	162.8	176.0
V	170.4	183.5
VI	160.3	177.8
VII	165.6	180.9
VIII	171.5	190.4

	1	2
IX	173.1	198.9
X	176.5	204.0
XI	177.6	207.0
XII	171.3	216.3

*See Production index computed according to list of articles in Wiadomosciach Statystycznych [Statistical News], 1949, No 15, page 170.

**Production index published in Wiadomosciach Statystycznych of 1950, No 5, page 1.

In the following years of the Three-Year Plan, the proportion of new articles previously not produced in the general value of production kept increasing. The production of these articles influenced the dynamics index of the total gross production of industry but had no effect on the representative dynamics index of the production computed from the established list of articles. For these reasons GUS discontinued the computation of the representative index and turned to the computation of the dynamics index of the total industrial production on the basis of its gross value, which reflects with greater reality the dynamics of industrial production.

In prewar Poland there was a period when the so-called systematic production dynamics index was applied. This was an index based on changes in employment in the manufacturing industry and in the mining and metallurgical production, but not on the changes which occur directly in the magnitude of production.

This index could not give a true picture of the dynamics of production, since, as is known, changes in the magnitude of production depend not only on changes in employment but also on the time put in by the workers, on changes in their productivity, on changes in value in ratio

to the total value of production, on changes in technical facilities in the plants, etc.

All the above shown indices are computed for full calendar periods. An index computed on the basis of these data gives the true picture for that specific period alone. It does not define the true dynamics of production. Furthermore a fall in the dynamics index of production in a given month may indicate not lower dynamics of production but simply fewer workdays.

We shall clarify this with an example.

Taking monthly production as a basis, we assume that during January gross production amounted to 400 million zlotys and in February to 392. The production index for February amounts to 98% by comparison with January.

If however we take the average daily production (workdays), we obtain an index equal to 102.3.

Produced in 1,000 zlotys

Gross Production	January (23 full workdays)	February (22 Full workdays)	Index
Monthly production	400	392	98
Average daily production	17.3	17.7	102.3

Inversely, the growth of production in a given period does not always indicate the growing dynamics of production.

Example: Produced in 1,000 zlotys

Gross production	February (23 full workdays)	March (26 full workdays)	Index
Monthly production	392	418	106.6
Average daily production	17.7	16.1	90.9

In order to decrease to a minimum the vaccilation of the dynamics index of production arising from variations in the studied periods, we introduce a correction for the average number of workdays.

A corrected index, corresponding to uniform periods, can also be obtained by multiplying the ordinary index by the correction coefficient obtained as follows.

$$M = d + 0.75s,$$

$$A_m = \frac{\sum d + 0.75s}{12}, \text{ and}$$

$$W = \frac{A_m}{m},$$

where d is number of workdays during month excluding Saturdays,

s the number of Saturdays during month (Saturdays are figured as 0175 days ($\frac{6}{8}$ hours))

m the number of full (8-hour) workdays in the month,

A_m the average monthly workdays, and

W the correction coefficient.

The following example illustrates the way to compute the corrected index.

Months	Calendar days	Sundays and holidays	Saturdays	Full Workdays Less Saturdays	Saturdays	Together	Corrected index
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
1947	365	64	51	250	38	288	1
1948	366	65	50	251	37	288	1
1949	365	65	52	248	39	287	1.0034
January	31	7	4	20	3	25	1.0434
February	28	5	4	19	3	22	1.0909
March	31	4	4	23	3	26	0.9230
April	30	5	5	20	3.8	23.8	1.0084
May	31	6	4	21	3	24	1
June	30	7	4	19	3	22	1.0909
July	31	6	5	20	3.8	23.8	1.0084
August	31	5	4	22	3	25	0.9600
September	30	4	4	22	3	25	0.9600
October	31	5	5	21	3.8	24.8	0.9677
November	30	5	4	21	3	24	1
December	31	6	5	20	3.8	23.8	1.0084

Below follows a table containing computations of the actual and corrected dynamics index.

DYNAMICS INDEX OF GROSS PRODUCTION OF HEAVY AND MEDIUM INDUSTRY AT CONSTANT PRICES*

Period	Actual dynamics index	Corrected dynamics index
1947	100	100
1948	142.7	142.7
1949	173.9	174.5
January	147.1	153.5
February	147.1	160.5
March	175.0	161.5
April	166.3	167.7
May	170.3	170.3
June	161.8	176.0
July	165.6	167.0
August	174.4	167.4
September	185.4	178.0
October	195.5	189.2
November	198.6	198.6
December	199.5	201.2

*Wiadomosci Statystyczne

IV. STATISTICS OF EMPLOYMENT

I. Osipow

1. General Concept of Statistics of Employment

Statistics of employment is one of the most important branches of industrial statistics because the labor force is a basic factor of the process of industrial production. For this reason too, the national economic plans and the technical, industrial, and financial plans define in detail the employment level in individual industrial branches, departments, and enterprises.

In order to assure the planned growth of production and services, the law regarding the Six-Year Plan establishes an employment growth in the socialized administration, outside of farming, of 60% over the year 1949, and of 65% in the socialized industry.

The exceeding of the planned employment level not justified by a corresponding increase in production is as negative a phenomenon as the failure to fulfill the industrial production quota.

The subject matter of employment statistics in countries building socialism and in the USSR differs basically from those in capitalist countries. In bourgeois Poland before the war, the subjects studied by employment statistics were, among others, the so-called labor disputes (strikes, lockouts, seizures of plants during labor disputes) unemployment, occupational migration of workers, and similar phenomena, which are entirely unknown now in the countries building socialism, in which every citizen has the right to work.

The phenomenon of unemployment in capitalist countries reaches especially catastrophic proportions. In the United States unemployment grew from 2.2 million before World War I to 10 million during the years 1931-1940.

After a war "despite the growth in war production, the number of unemployed or semiemployed increases in capitalist countries. In Italy and Western Germany unemployment exceeds the level of that during the years of the gravest economic world crisis during 1929-1933. In Italy there are over 2 million totally unemployed and still more semiunemployed, and in Western Germany practically 3 million totally and partially unemployed. Japan has more than 10 million totally and partially unemployed. The United States have at least 3 million totally unemployed and 10 million partially unemployed. Unemployment in England is growing, having already reached half a million people. Such a small country as Belgium numbers more than 300,000 unemployed" (speech of G. M. Malenkov at the Fourteenth Convention of the CPSU [Communist Party of the Soviet Union] Nowe Drogi [New Roads], Special Number, 1952, page 19).

In studying unemployment, official bourgeois statistics constantly strive to decrease the number of actually unemployed. This is achieved by the omission of the partially unemployed people who work only a few days a week or even a month. The computations also omit the large mass of the farming proletariat, which is not included in labor. Frequently seasonal workers are omitted, and as a matter of policy the "unemployed since birth," the growing youth which despite achieving the proper age has not yet succeeded in obtaining employment, are omitted. Another factor in the lowered unemployment figure is the practice in some countries of not including in the computations foreigners, workers lacking proper documents, or workers who have been taken off the unemployment rolls after a given period of a fruitless search for employment. Thus official industrial statistics in bourgeois countries strive to gloss over structural unemployment, the shameful brand of capitalist society.

The "principles of the Six-Year Plan for the economic development and reconstruction of Poland" characterizes unemployment statistics in pre-September Poland as follows.

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"In 1937 there were officially registered 375,000 unemployed, constituting 13.1% of the entire working population. These figures did not reflect the unregistered unemployed, unemployment among women and youth, partial unemployment, or the so-called 'superfluous' farm labor" (Minc, H., Osiagniecia i plany gospodarcze [Attainments and Economic Plans],1949, Ksiazka i Wiedza, page 83).

Important tasks of employment statistics in People's Poland include studies of the number of employed workers, structure of employment, employment trends, utilization of existing labor reserves, dynamics of employment, and the control of employment quota fulfillments and intraplant training.

Another task of employment statistics is the submission of balances of reported manpower.

2. The Size of the Work Force

The precise definition of the size of the work force is an essential condition for statistical studies of employment and for the attainment of comparable statistical data.

The work force of a plant comprises only those workers who appear on the employment roster of the given plant.

A worker belongs to the work force from the moment he is hired, even during the trial period, to the moment his name is taken off the employment roster.

The inclusion or the removal of a worker's name from the employment records is based on the entering or dissolving of the work contract between him and the enterprise.

In view of the character of the legal relationship between the worker and the plant, we distinguish: permanent workers, whose period of employment is not defined in advance in the work contract; temporarily employed, hired for a specified period only, usually one of several months; and workers employed occasionally, who were hired to do a specified job which does not normally come within the scope of a given workshop. Occasional workers are not included in the work force. Temporary workers also includes seasonal workers, or workers hired for a period specified in advance for natural or other yearly recurring conditions of production (for example, the campaign in the sugar industry, etc).

Among administrative and office or engineering and technical personnel, are to be distinguished the full-stage employees (full-time), employed for the full extent of the work period defined by prescribed regulations and the incomplete-stage (part-time) employees, employed by a given enterprise not for the full work period, as for example legal advisors, plant physicians, experts, etc. Incomplete-stage employees belong to the work force of the given enterprise, since their occupation there is their basic profession.

Workers are also included in the work force in cases of temporary absence from work, for example, in case of illness, vacation, military service, absence due to additional training or social occupation, etc.

One should also distinguish between the number of workers present on the job on a given day and the number taken from the employment records of that day, since the 2 concepts are entirely different.

Workers temporarily assigned from their home enterprise to work in a different enterprise continue to belong to the work force of the home enterprise, however the time worked by them and their wages are

included in the reports of the enterprise in which they actually did the work.

Students attending school and present in the enterprises for vacation or diploma practice are not included in the work force.

3. Computation of the Number of Workers

The numerical strength of the crew employed in an industrial enterprise can be defined according to the number on a given day or according to the average number for a given period.

Computation of the number of workers according to the number on a given day, let us say the first or last day of the month (10-day period, quarter, year) presents no difficulty and requires no explanation. The number of workers on a given day is computed from the sum of the present and absent workers which appear on the employment roster of the enterprise.

However the number of workers on a given day does not sufficiently characterize the size of employment, if significant variations occurred in the number of employees during the period under study.

Let us assume that we are exploring the size of the work force, for example in the sugar industry during the last month of the campaign, that is, in December, and that we define the magnitude of employment according to the size of the work force on the first day of the studied month.

It is clear, that on 1 December, when the campaign is still in full force, the number of employees will be several times as large in the sugar mill as on 31 December, when the campaign is reaching its end.

Furthermore one ought to keep in mind that the employment plan

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contains figures concerning the average level of the crew for a quarter or a year and not on a given day. In view of the fact that one of the most important tasks of statistics is the supervision of plan fulfillment, it is essential to apply the methods of statistics to those of planning and to computing the average size of the work force. Computation of size of the work force as an avexage recorded number of workers for a given period is essential also in defining the level of productivity, which is computed, among other ways, as the ratio of the performed production within a given period to the average number of workers for this same period.

We compute the number of employed according to the size on a given day only in those cases where it is not subject to any significant changes in successive points of study, or where the study concerne small reporting units whose regular working force is not significant, or where particular considerations call for a certain method of computing the employment level.

In statistical reporting of heavy and medium industry, as well as of small state industries, the number of employed during the report month is computed basically as the average recorded number of employees for a given period, excepting the central administrations or equivalent units and other administrative units for which a separate quarterly report is drawn, and where the number of workers is established by dividing into 3 the average number of employed on the last days of the 3 months of the quarter.

The average number of employees in a given enterprise, let us say for the month, is obtained by obtaining the arithmetic average so that the number of recorded employees for each day of the month is added and divided by the number of calendar days in that month.

For example, in enterprise "A" in August 1953 the number of recorded employees by the day was as follows.

	Number of Workers
August 1	240
2 (Sunday)	240
3	248
4	248
5	253
6	255
7	255
8	250
9 (Sunday)	250
10	248
11	248
12	245
13	244
14	245
15 (Holiday)	245
16 (Sunday)	245
17	258
18	258
19	260
20	258
21	256
22	255
23 (Sunday	255
24	253
25	255

August 26	253
27	254
28	255
29	255
30 (Sunday)	255
31	256
Total	7,795

The average number of employees amounts to 7,795÷31 = 351.

In accordance with the binding instruction of GUS, the size of the work force on a day free from work (Sunday or holiday) is established according to the preceding workday and therefore in the given example the size of the work force on Sundays and on the holiday was exactly equal to the employment on the days preceding them.

The application of this method creates certain doubts. It concerns the fact that actual changes in employment (hiring, releases) happen on an actual workday but find their reflection in the records of the following day only. When they happen on a day preceding a nonworkday, they are reflected only on the third day, that is, the following workday. For example (Rotsztejn, A. I., Problemy promyshlennoi statistiki [Problems of Industrial Statistics], Vol II, 1938, Moscow, page 245):

Date	Number of Employees
April 1	3,500
2	3,430
3 (nonworking)	3,430
4	3,520
5	3,540
6	3,480
Total	20,900

The average number of employees equals 20,900 + 6 = 3,483.

The figure 3,483 does not truly characterize the average size of the work force during the period under study. From the cited example it can be seen that considerable changes took place on the second day when the number of employees rose from 3,430 to 3,520. These changes however were not reflected the following day, since that was a nonworkday which by agreement copies the number of employees of the preceeding day.

Thus the arbitrarily accepted level of employment of 3 April differs from the actual recorded level on that day, that is, from the figure 3,520 employees (or from the level of employment as shown for 4 April). For that reason some people advocate the listing of employees on a nonworkday as the same number that appears on the following nonworkday.

In the given example it would have to be listed as follows.

Date	Number of Employees
April 1	3,500
2	3,430
3 (nonworkday)	3,520
4	3,520
5	3,540
6	3,480
	20,990

The average number of employees would be 20,900 ÷ 6 = 3,498 and not 3,483 as shown before.

The problem of selecting the proper method of computing the size of the work force on nonworkdays does not have too much of a practical

value, since vaccilation in the work force during 2 or 3 days are slight excepting the cases when the nonworkday falls following the first or fifteenth of the month when the greatest changes (hiring, releasing) in the work force occur.

The difficulty of establishing the employment level on nonworkdays would disappear completely, were we to figure the average number of employees only during workdays in the studied period. This method of computation is even the only justifiable one in the computation of some measures characterizing the degree of work time utilization.

The binding method of computing the average number of workers from the total calendar days is based on the fact that in some plants part of the crew also works on nonworkdays. This would entail the acceptance of a differing number of work days for enterprises within one central administration or branch of industry, which in turn would obscure the total picture of the size of the work force in the given central administration or branch of industry.

In practice there may be cases where an enterprise stopped or began its work, let us say, in the middle of the report month. In other words the enterprise was not active during the entire month. In such a case, according to binding instructions, the average number of employees is computed in such a manner that the sum of the daily employment levels during the working period of the enterprise in the report period is divided by the total number of calendar days of the month, and not by the number of days in which the enterprise was active.

For example, enterprise No 2 was started 28 April, the recorded number of workers was as follows.

April 28 -- 1,000 workers

April 29 -- 1,000 workers

April 30 -- 1,000 workers

The average recorded number of workers in enterprise No 2 for April is computed by dividing the sum of daily totals in April by the number of calendar days during that month, that is, 30:

$$\frac{1,000+1,000+1,000}{30} = \frac{3,000}{30} = 100,$$

and not by the number of workdays in April, namely 3.

The correctness of this method of computation can be proven by the following example.

Let us assume that in enterprise No 1, which was active during 30 days in April, the average recorded number of workers was 1,000 workers, and that this enterprise produced 5 million zlotys worth of goods. On the basis of these data we can easily compute the value of production per one workers (productivity):

$$\frac{5,000,000}{1,000} = 5,000 \text{ zlotys.}$$

Assuming next that the productivity in enterprise No 2 was the same as in No 1, we could compute that with the same number of workers (that is 1,000) enterprise No 2 produced 10 times less than enterprise No 1, that is, 500,000 zlotys, Enterprise No 2 was active for a period 10 times shorter than enterprise No 1 (3 days and not 30).

Applying the method of computation established by GUS instructions, we obtain the correct picture of average productivity in both enterprises, namely

$$\frac{5,000,000+500,000}{1,000+100} = \frac{5,500,000}{1,100} = 5,000 \text{ zlotys.}$$

Were we, on the other hand, to compute the average number of workers in enterprise No 2 by dividing the sum of the daily employment levels by the number of workdays during the month:

$$\frac{1,000+1,000+1,000}{3} = \frac{3,000}{3} = 1,000,$$

we would obtain a distorted picture of the productivity level of work in the 2 enterprises, namely

$$\frac{5,000,000+500,000}{1,000+1,000} = \frac{5,500,000}{2,000} = 2,750 \text{ zlotys,}$$

which clearly does not correspond to the real state of affairs. Collective work, Kurs ekonomicheskoi statistiki 1952, Moscow, pages 235-236).

As a result of applying the method established by GUS instructions for computing of the average recorded number of workers we avoid the danger of a seeming increase in the number of workers in compiling summary reports from unit reports regarding the level of employment in seasonal enterprises, in which workers from one enterprise may have passed to another during the month under report.

For example, let us assume that enterprise No 1, which employs an average of 1,000 wprkers was active only from the first to the fifteenth of April. On the closing of enterprise No 1 all the workers of that enterprise were transferred to the newly activated enterprise No 2, where they worked from the sixteenth to the end of the month, for a period of 15 days.

The average employment level in both enterprises, using the correct method of computation, is

$$\frac{15,000}{30} + \frac{15,000}{50\ [sic]} = \frac{30,000}{30} = 1,000 \text{ workers,}$$

otherwise, the actual number of people employed.

Were we, on the other hand, to compute the average employment level by dividing the sum of the daily employment levels by the number of workdays of the enterprise, and not the number of calendar days, we would obtain a false picture of the employment level:

$$\frac{15,000}{15} + \frac{15,000}{15} = \frac{30,000}{15} = 2,000 \text{ workers,}$$

whereas in reality the employment level was only 1,000 workers.

The given method of computing the average employment level for enterprises active during only part of the report period is not used when grouping industrial plants and enterprises according to the number of employees. In such a case, it is necessary to divide the sum of the daily recorded employment levels by the number of working and not calendar days, since only in this manner will we obtain the true picture of the employment level in a given enterprise or plant.

The average quarterly number of employed is computed by adding the average monthly employment levels and the total divided by 3 (No of months during quarter), regardless of the number of working days during the individual months. Theoretically this method is incorrect, since we completely ignore the fact that the number of workdays during the various calendar months varies. A more accurate measure of the average quarterly employment level is the arithmetic mean of the averages of employment levels during each month weighed against the number of calendar days during each of these months.

Example:

Month	Number of Calendar Days	Average Monthly Size of the Work Force
January	31	2,200
February	28	2,300
March	31	2,500

The average size of the work force during quarter computed according to:

(a) ordinary arithmetic mean:

$$(2,200+2,300+2,500) \div 3 = 2,333,$$

(b) weighed arithmetic mean:

$$\frac{(2,200x31)+(2,300x28)+(2,500x31)}{31+28+31} = 2,334.$$

In practice the average employment level for the quarter is computed with the aid of the ordinary arithmetic mean without taking into account the difference of the number of calendar days each month, since the difference is the result is very slight.

MODEL 1/IV

AVERAGE EMPLOYMENT ACCORDING TO PERSONNEL RECORDS

Serial No	Itemization	Planned for report month	Average Number of Employees Actual			
			During report month	Same month 1954	From beginning of the year to end of report period	Same period 1954
1	2	3	4	5	6	7
1	Total					
2	Workers included					
3	Industrial group (items 5+7-11)					
4	Including employed in by-production					
5	Workers					
6	Including steadily employed					
7	Engineering and technical workers					
8	Administrative and office workers					
9	Service workers					
10	Guards					

1	2	3	4	5	6	7
11	Students					
12	Total nonindustrial workers					
13	Group for repair of capital construction and equipment					
14	______________					

15 From the total number of employed (item 1, column 4):

(a) Total female __________ workers included __________

(b) Total youth __________ girls included __________

The actual average number of workers from the beginning of the year to the end of the report month (See Model 1/IV, column 6) is computed as follows. The sum of the monthly averages is divided by the number of months in the period. This method of computation should also be applied when the enterprise was not active from the beginning of the year. For example, the enterprise started in May. The average employment was 800 workers in May and 1,000 workers in June. The average employment from the beginning of the year to June is

$$1{,}800 \div 6 = 300.$$

The average yearly employment is computed by dividing the sum of the monthly averages by 12 (number of months in year).

The average yearly employment for a seasonal plant which was active during several months (for example, an ice producing plant which was active for 6 months, May to October) is computed by the sum of the averages of the monthly employment for 6 months divided by 12.

4. Grouping of Workers

Basic Grouping

According to the principles accepted in planning and statistical reporting, workers employed in an industrial enterprise are divided according to the kinds of activity performed by the enterprise, in which the workers are employed.

This division is based on the fact, that for the purposes of the computation of the productivity, production costs, etc, there arises the necessity of associating the results of certain activities directly only with the number of workers employed at these activities.

On this basis workers in industrial enterprises are divided in

accordance with GUS instructions into the following groupings: (a) the industrial group, (b) the nonindustrial group, and (c) the repair of capital construction and equipment group.

The basic and most numerous group in the enterprise is the industrial group.

In this group are included all workers employed directly or indirectly in the basic activity of the enterprise, that is, in industrial production and those whose pay increases the costs of industrial production.

To the nonindustrial group belong the workers who do jobs not connected with the basic activity of the industrial enterprise and whose pay does not increase the cost of production. In particular to the nonindustrial group belong workers employed in the administration of housing, hotels and boarding houses, ambulance workers, etc. To this group also belong workers of railroad (railroad siding), automobile, and water transportation and workers employed for loading and unloading in cases where transport in an enterprise is singled out as a separate unit with an independent economic account. Finally, to the nonindustrial group belong the workers employed to watch inactive facilities belonging to an active industrial enterprise.

To the third group, for repairs of capital construction and equipment, belong those workers who are steadily employed for such works done by an enterprise for economy purposes.

The apy of these workers does not increase production costs, since they are paid out of funds especially earmarked for this purpose. This group does not include workers employed in SOWI [Samodzielne Oddzialy Wykonawstwa Inwestyeyjnego -- Independent Divisions of Investment Fulfillment, since these workers are included in reports concerning investments.

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In some branches and groups of the food and farm products industry there appear in addition the following groups of workers.

The plantation group, which includes all workers employed on the plantations and in other activities involving the supply of vegetable raw material to the industrial plant, such as, for example, harvest workers, contracting, etc.

The contracting group, which includes, only in the meat industry, workers employed in livestock contracting.

The marketing group, to which belong, in some organizational units, workers employed in expediting and selling the products of industrial enterprises. In small socialized industries to this group belong workers employed in model stores not concerned with employment plans for commodity turnover.

The industrial fattening fodder group, appearing only in the dairy industry, which includes workers employed exclusively for work with industrial fattening fodder crops.

The above-mentioned groups of workers constitute the most general groupings of workers employed in industrial enterprises and to each group belong workers executing a variety of functions in the enterprise, starting with a messenger and ending with the director of the plant. Comprehension of the employment structure requires a more differentiating division of workers into groups more uniform with respect to the functions they perform.

On this basis, a further division into subgroups is applied within each of the above groups.

In the industrial group workers are divided into the following subgroups: (a) workers, (b) engineering and technical workers, (c) administrative and office workers, (d) apprentices, (e) service workers, and (f) guards.

Workers include all employees, directly or indirectly connected with the process of industrial production.

To the workess subgroup belong, first of all, all workers employed in the basic productive departments of the enterprise, who are concerned in the direct action on the subject of work, as well as those employed outside the plant premises in the installation of the items produced by the plant.

This subgroup includes as well the workers employed in the auxiliary productive departments of the enterprise, for example the power plant employees, boiler firemen, etc. To this subgroup also belong all workers employed in maintaining the servicing of the production process and the means of production, such as workers in the laboratories serving the industrial process, workers employed on current, medium, and capital repairs or other industrial tasks, performed for plant investment with the exception of construction or installation works. Also considered as directly serving the production process are cleaners of production premises, since their work enables the proper functioning of the production process.

The workers subgroup also includes employees of intraplant transportation (for example ground workers), as well as those employed in outside transportation, provided this outside transportation is not singled out as an independent accounting unit.

The dividing line between the workers subgroup and the other subgroups becomes clear when the scope of the work of the other subgroups is defined.

Engineering and technical workers include workers, regardless of their educational status, who execute functions of the technical direction of the industrial process which essentially require the qualifications of an engineer or a technician.

Binding regulations list the functions to be filled by workers included in the engineering and technical subgroup.

To the engineering and technical subgroup belong the following.

(a) Workers filling the functions of the chief technical direction of the industrial process, such as directors and their technical assistants, chief engineers, metallurgists, technologists, etc.

(b) Other workers directing the technical process of production, such as engineers, technicians, foremen, etc.

(c) Workers giving direction of a technical nature which are indirectly associated with the process of industrial production, for example, chief mechanics, chiefs of the power station and automobile transportation, chief supervisory inspectors, and directors of the technical supervision department (if the position requires the qualifications of an engineer or a technician), directors of the departments of technical production, preparation for production, construction, etc.

(d) Workers discharging directive functions of an organizational and administrative nature, if their positions require the qualifications of an engineer, technician, economist or planner, for example, the directors of the departments of planning, organization of work and wages, supply and marketing, etc.

(e) Other workers discharging functions requiring the qualification of an engineer or technician, such as inspectors or technical supervisors, inspectors of work safety and hygiene, work norming technicians, laboratory assistants, designers, technical draftsmen, etc.

We mentioned before that the inclusion of a worker in the engineering and technical subgroup of workers is determined by the function he performs

and not by the degree he possesses. Thus a worker performing the duties of a foreman or a director of automobile transportation will be included in the engineering and technical group, whereas a man having an engineering degree and working as the head of the personnel department will be included in the administrative and office workers group.

The administrative and office workers subgroup includes those workers who perform duties of administrative, economic, or office nature only indirectly connected with the material process of production. This subgroup includes workers discharging directive administrative functions, such as the acting director of the enterprise (administrative, financial, trade), directoss of the departments of accounting, personnel, finance, administrative, and economic, as well as the department of supply and marketing, if this position requires the qualifications of an engineer or technician.

The administrative and office subgroup also includes all other workers performing administrative and office functions, such as accounting, planning, statistics, personnel, industrial safety checking, office (recorders, secretaries, typists, stenotypist, etc) legal advisors, translators, managers, expeditors, storeroom clerks (excluding workers employed in stock rooms), clerks, telephone operators, etc.

To the subgroup of students belong all workers who appear on the personnel records of the enterprise who were engaged on the basis of a trade study and not on the basis of a work agreement.

Students pass the trade study in the plant singly or in groups and, especially important, they are paid at a student rate. As a rule, regulations require a shorter workday for students. The student's status is determined by his trade-study contract and by his student pay rate, not by his age.

The separation of this subgroup in statistical reporting is based on the necessity for statistical studies of the strength of the reserve working force prepared by an enterprise in its own field. Furthermore in some statistical studies the separation of students is significant, for example, in the computation of productivity, since the productivity of a student is usually lower than the average productivity of a qualified worker.

The student subgroup should include only those students who undertake the study of a trade within the industrial activity of the plant. A so-called office practitioner should not be included in the student subgroup but should be included in the administrative and office group.

Neither should the student subgroup include workers receiving normal pay rates who supplement their qualifications by training within the scope of the intraplant and workshop training program.

In nonsocialized workshops, the grouping of apprentices was done according to the years of apprenticeship. However, since the training period required differed in various kinds of workshops, this type of grouping was abandoned.

The service workers subgroup includes workers who perform auxiliary functions not connected with the material production process, such as janitors, messengers, porters, sweepers, stokers and cloakroom attendants of administration premises, chauffeurs of personal automobiles, etc.

The work of these service workers has no direct bearing on the results of the basic activity of the industrial enterprise, and excesses in the number of these workers has a direct influence on the increase in operating costs and on the lowering of the productivity index of the enterprise. In view of the performed functions, the service workers

subgroup primarily includes unqualified workers, whose average pay is basically lower than the average pay of the workers of other subgroups.

The subgroup named "guard" includes all workers of the industrial or firefighting guard, regardless of rank, therefore including rank and file as well as noncommissioned and commissioned officers alike.

Workers of the construction and installation investment and capital repair group are divided into the following subgroups: (a) workers, (b) engineering and technical workers, and (c) administrative and office workers; and in the nonindustrial group into the following subgroups: (a) workers, and (b) administrative and office workers, essentially along the same lines adopted in the division of the industrial workers.

In the summary presentation of all employment groups in required statistical reports, the total of employees of an enterprise are grouped according to the following subgroups (regardless of the main grouping of the workers): (a) workers, (b) engineering and technical workers, (c) administrative and office workers, and (d) students, service workers, and guards.

Inclusion of a worker into the proper group or subgroup of employment is done in an enterprise from the data of the personnel department. Temporary employment of a worker in a different division has no effect on his regular grouping. Thus, for example, a service worker temporarily employed as an industrial worker is listed as a service and not as an industrial worker.

Workers of the so-called starting brigades [of new plants], are included in the groups and subgroups according to the work in which they are actually engaged.

Central administrations of industry and equivalent units as well as other "trouble-shooting" units are not included in reports on industry and divide their workers into full and part-time employees. The full-time group is divided into administrative office workers and into service workers. Service workers include janitors, guards, messengers, porters, cloakroom attendants, cleaning women, chauffeurs, shop workers, etc.

In some branches of industry the generally adopted grouping of workers is subdivided even further and some subgroups are broken down further.

In the coal industry the engineering and technical workers are divided into those working (a) underground or opencast, and (b) on the surface, and the underground and opencast workers are further divided into those working at (a) mining of the coal, and (b) gangue drilling and maintainance. Workers of both groups are divided into (a) miners, (b) junior miners, and (c) loaders.

Among other workers employed underground and in an opencast and on the surface there are distinguished the (a) qualified, and (b) non-qualified workers.

In the 'guard' subgroup in the coal industry the industrial and fire guards are grouped separately.

In cooperative industry, in addition to the use of the usual groupings one distinguishes members of the cooperative, candidates for membership, and domestic manufacture workers.

As domestic manufacture workers are considered those workers employed off the shop premises in their own home, and whose working time is not regulated. These workers get paid by the shop according to agreement.

The existence of this group is justified by the fact that some workers are not able to comply with required work regulations in the shop (for example, invalids, women running households and taking care of children, owners of small farms, etc), and the work given them can be performed at home, since it does not require any special machinery or facilities. Sometimes the existence of this group is due to the fact that the shop has limited quarters which cannot accommodate the full crew. Thanks to this form of employment the people's state provides an opportunity to work even for those who cannot work outside of their homes.

The present-day concept of the domestic manufacture worker does not have much in common with the 'sweatshop' worker in the prewar sense. In the capitalist system the domestic manufacture workers were the most exploited group of workers in their class, whose misery and oppression have become proverbial. In view of this, the unfortunate name of 'sweatshop' worker should be replaced with another to deprive it of its derogatory sense.

In planning and statistical reporting work a method was adopted to convert domestic manufacture workers into regular workers and domestic work hours into regular man-hours. This method is illustrated in the following example.

Let us assume that an enterprise is planning production in the value of 600,000 zlotys, of which a production of 480,000 zlotys is planned to be fulfilled by 60 fully employed workers on the premises and the balance of 120,000 zlotys by domestic workers. In view of the fact that one fully employed worker will produce 8,000 zlotys worth (480,000÷60), it follows that the balance will be fulfilled by 15 domestic workers computed into regular workers (120,000÷8,000), regardless of the actual number of domestic manufacture workers employed for the purpose.

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This method is not widely used in such statistical studies as the computation of labor force reserves and productivity, because it does not give a correct picture of employment, average productivity, etc.

Some difficulties arise in statistics of cooperative industry in studies of the employment level according to shops.

As is known, in cooperative work the cooperatives are enterprises comprising various workshops. Each of these workshops has its own crews, in addition to which all of these shops are serviced jointly by administrative and office and engineering and technical workers of the entire cooperative, such as the planners, accountants, engineers, etc. The breakdown of the administrative and office or engineering and technical subgroups into parts, dividing them into the number of member workshops and the distribution of the obtained portions in the employment levels of the various shops is not desirable, since the resultants are frequently not whole integral numbers.

For example, a cooperative comprising 6 shops has 3 accountants serving all the shops. Were we to divide the number of these workers into the number of shops, we would obtain 0.5 workers per shop, which does not make sense. In the early period after the war, it was accepted that in such a case workers serving the entire cooperative should be included with the highest numerical group of workers in the enterprise. (See: St. Rog, Klasyfikacja zakladow przemyslowych [Classification of Industrial Plants, Number 4, Series D, 1947, GUS, page 8.)

In private industry the basic grouping of employees excludes owners, partners, agents, or members of their families. A different procedure would cloud the class picture in private industry. If therefore an owner of

a shop also discharges the function of a worker in the shop, he should be listed in the report not in the 'workers' subgroup but in a separate subgroup of 'owners employed in the shop.' In a separate subgroup should also be listed members of the owners family who perform any function in the shop whatever, but who are not subject to the work regulations of the shop and who are not compensated from the payroll funds. On the other hand, members of the owners family who draw regular pay for their services and are insured by ZUS, [Zaklad Ubezpieczalni Spolecznej -- Social Insurance Institute], should be treated as hired help and grouped according to the type of work they perform.

It is noteworthy that prewar attempts to group owners of industrial shops and the members of their families into physical and mental workers, just like the hired help, were not successful. In practice however, especially in small industrial workshops, the owners frequently sporadically coupled physical labor with constantly performed administrative and supervisory functions, in view of which their inclusion into one or the other group was rather indecisive. Data concerning the years 1934-1935 reveal the character of this situation.

TABLE 1/IV

EMPLOYMENT OF OWNERS AND MEMBERS OF THEIR FAMILY IN INDUSTRY IN THE YEARS 1934-1935

Itemization	1934	1935
Total	18,883	16,727
Physical	6,673	9,719
Mental	12,210	7,008

Source: Statystyka Przemyslowa 1935 [Industrial Statistics 1935], 1937, Warsaw, page XVI.

As is seen from Table 1/IV, against an insignificant decline of the total number of employed owners and members of their families during one year there occurred a drastic increase in their employment as physical workers and a decrease in their employment as mental workers.

This phenomenon was caused by nothing more significant than the change in composition of the report form, in which a change of columns occurred as follows.

Column Sequence in Form

1934	Mental workers	Workers
1935	Workers	Mental workers

In view of the fact that the proper classification was always doubtful, as discussed above, the owner usually listed himself and the members of his family in the first column. The change in column sequence caused a fictitious drastic change in the employment structure of owners and members of their families.

Employment statistics of pre-September Poland applied primarily a division of hired labor into physical and mental workers.

The guiding criterion for this division was the category of social insurance carried by the workers.

Mental workers included, according to regulations for the insurance of mental workers, persons fulfilling administrative or supervisory functions. Other hired workers not covered by this type of insurance were listed as physical workers.

The application of this division was fully justified in the conditions of the capitalist economy. "The economic foundation of the opposition between mental and physical work is the exploitation of physical labor

by the representatives of mental work. Everybody knows what a vast abyss existed between the physical laborers of an enterprise and the directing personnel under capitalist conditions. It is known that on this ground developed the wrong attitude of the workers to the director, foreman, engineer, and other representatives of the technical personnel as to their enemies. Naturally, in addition to the liquidation of capitalism and the system of exploitation, the opposition of interests between physical and mental labor had to disappear. And indeed it disappeared in Russia's present socialist system. Now physical workers and the directing personnel are not enemies but comrades, friends, members of one productive collective, deeply interested in the successful development and improvement of production. From the old enmity between them remained nothing." (Stalin, I. V., Ekonomiczne problemy socjalizmu w ZSRR [Economic Problems of Socialism in the USSR], 1953, Ksiazka i Wiedza, pages 43-44.)

Under conditions of the socialist system, the division of workers into physical and mental loses its significance as a basic division equally, as a result of the raising of the cultural and technical level of the physical workers to the level of engineering and technical workers. In connection with the uninterrupted growth and improvement of socialist production on a foundation of the highest techniques and the mechanization and automatization of the production processes, the function of the worker veers evermore toward the direction and supervision over the workings of mechanisms and equipment, and toward a constantly decreasing expenditure of live strength, the physical energy of the human organism.

For this reason too there would now be no justification for the classification of a highly qualified worker supervising the functioning of highly complicated equipment and precision instruments in a completely automatized power station as a physical worker, and a telephone weperator

mechanically operating a manual switchboard, as a mental worker.

The disappearance of essential differences between physical and mental labor does not mean the disappearance of all differences. "The essential difference between them in the sense of the margin in the cultural and technical level will disappear absolutely. Some nonessential difference however will still remain, if for no other reason than because the conditions of work of the directing personnel of an enterprise are not the same as the conditions of work of the laborers" (Ibid., page 47).

Generally speaking the difference in the conditions of work of physical laborers and mental workers lies in the fact that the laborer remains in direct contact with the machines or the equipment used in the productive process of an industrial enterprise, while the mental worker maintains only an indirect contact with them. There is no contradiction between this criterion and the fact that mental workers also use machines and equipment (for example, for computation) but of a kind not directly employed in the process of production.

We also used the division of workers into physical and mental in the first postwar period (See: Statystyka Przemyslowa 1946, Statystyka Przemyslowa 1947, Rocznik Statystyczny 1948 [Statistical Yearbook 1948], Wiadomosci Statystyczny 1950, et al., GUS edition). In the above sources physical and mental workers were further defined as 'hired.' The application of the word 'hired' to workers in a socialized industry is completely senseless. "Now, under the conditions of the USSR's system, words describing the labor force as a commodity, or speaking of workers as 'hired' sound absurd, as if the laboring class owning the means of production could hire itself or sell to itself its own labor force" (Stalin, J. V., Op. Cit. page 30). On the other hand, the application of this term is

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justified in nonsocialized industry in order to distinguish between hired workers and the owners or the members of their families employed in their own industrial enterprise.

Attempts were made to divide industrial workers into qualified and nonqualified ones. This kind of grouping proved very difficult for the lack of definite precise criteria common to all branches of industry. For this same reason, this kind of grouping is applied in practice only in internal reporting of some organizational types of entirely undiversified enterprises (for example, hard coal mines).

Other Groupings of Workers

Beside the basic grouping of workers, statistical studies in practice also use other groupings also having to do with the subject matter of central or internal reporting.

Of great importance is the grouping of workers by sex. This permits the division of the total number of employed workers and the observing of the increasing employment of women in the various branches of industry. Resolution No 620 of the Government Presidium of 17 July 1952 regarding the increasing in employment of women in the national economy (Monitor Polski No A-28, position 1,160) placed upon ministers the obligation to establish a minimum percentage of women in the total working crew to be achieved by the factories in various years and a listing of occupations and work-posts to be limited to men in view of the women's inadaptability to them.

In order to obtain a clearer picture of the size of the female work force, it is necessary to maintain the separation not only for the total number of workers but also in the specific groups or subgroups. In accordance with the binding regulation of GUS the monthly reports of industrial enterprises contain data concerning the total number of women

employed, with the specification of the number of women laborers.

An interesting light on the participation of women in employment is shed by the study of the percentage of women by plant size, as is shown in Table 2/IV.

EMPLOYMENT OF WOMEN BY PLANT SIZE (January 1934)

Size of Plant by number of employees	% of plants	Percentage of Women in Relation to the total number of workers
up to 49 workers	63.8	21.8
50-199 workers	26.5	30.7
200-999 workers	8.6	36.9
1,000 and above workers	1.1	51.6

Source: Czajkowski, Tadeusz, "Age and Years of Employment of Industrial Workers in Poland," Statystyka Pracy 1936 [Labor Statistics 1936], pages 4-21.

It is seen from the table above that the largest participation of employed women in the prewar period fell in plants of highest employment constituting barely 1.1% of the total number of plants. The high percentage of women in plants employing over 1,000 people is explained by the fact that the majority of this group of plants consisted of textile plants, comprising in round figures 60% of the plants and 70% of the workers, in which primarily women were employed.

Workers in industrial enterprises are also grouped according to age. Monthly reports of industrial enterprises contain data concerning only the number of young workers (that is, up to the age of 18) with specification as to the number of girls involved. More detailed studies are made on a yearly basis, on the status as of 31 March. In this report all workers are grouped in 14 age groups, specifying laborers' subgroups (including apprentices), and a division by sexes (See Model 2/IV).

Model 2/IV

EMPLOYMENT ACCORDING TO AGE AND SEX

Serial No	Years of Birth of employees	Number of Employees: Total number of employed including laborers (including apprentices): Total (Columns 4 and 5)	Men	Women	Total (Columns 7 and 8)	Men	Women
1	2	3	4	5	6	7	8
1	Total (lines 2-15)						
2	1940						
3	1939						
4	1938						
5	1937						
6	1936						
7	1935						
8	1934						
9	1933-1929						
10	1928-1924						
11	1923-1914						
12	1913-1905						
13	1904-1899						
14	1898-1894						
15	1893 and below						
16	Number of part-time workers						

A more frequent study of the composition of workers by age is not necessary, since essential changes in this composition do not occur within short periods of time.

On the basis of such reports it is possible to compute with the aid of medians the average age of the worker of an enterprise, central administration, and branch of industry, which in turn forms a basis of comparison of the average age of the workers in various enterprises and branches of industry. Furthermore, the study of the employment level by age gives a basis for the estimating of prospective labor reserves.

The selection of a proper number and margin of the age groups depends upon the purpose of the study. In the Soviet Union in current reporting workers are grouped in the following age groups: up to 18, 18-23 years inclusive, and 24 and above.

Yearly surveys are more detailed. For example, in the report form for the number of workers in the USSR by sex and age as of 1 August, 1951, the following age groups were adopted.

TABLE 3/IV

Series No (Symbol)	Age Groups A	Total Workers Including Laborers and Apprentices Men 1	Women 2	Total 3	Men 4	Women 5	Total 6
1	Up to 16 years						
2	16-17 years						
3	18-19 years						
4	20-25 years						
5	26-35 years						
6	36-49 years						
7	50-54 years						
8	55-59 years						
9	60 years and above						
10	Total						

Workers of an industrial enterprise are grouped also according to length of service. Such a study was made, for example, in 1953 as of 31 March, but only in relation to engineering and technical workers, since the length of service has an essential significance primarily in these subgroups. A worker, working for any length of time at a given workpost, has acquired production habits which a newly employed worker lacks. Similarly, an engineer employed for any length of time by the same enterprise has a better knowledge of the conditions and organization in this enterprise, than does the newly arrived man.

However employment composition by length of service in a given enterprise is not sufficient. It may happen that a worker has been at a bench in an enterprise for 10 years and been a lathe operator for one year. In other words, he has a total length of service of eleven years. It is quite clear, that in this case we deal not with a highly qualified lathe operator of eleven years' experience but with a beginner who does not as yet possess the full qualifications of the trade. It may also happen that a man has worked as a lathe operator in a given enterprise for only 6 months but has had 10 years' experience at a different enterprise.

It may be seen from the above example that a study of workers by length of service in a given enterprise gives a picture of only the degree of stability of the crew of a given enterprise or the degree of its association with a given place of work, but it is difficult on the basis of these data to arrive at the correct picture of the workers' qualifications.

Regulations for 1953 require that workers transferred in service be given credit in statistical reports for prior years worked in other enterprises.

However this regulation corrected only partially the lack of information regarding the length of service in a given trade.

In a deeper study of employment according to length of service, it is necessary to group workers according to the number of years they worked in: (a) industry, (b) in a given branch of industry, (c) in a given trade, (d) in the given enterprise, and (e) in the given trade in the given enterprise.

From required reports in 1953, a study was made of the structure of employment by length of service with the following divisions.

EMPLOYEES ACCORDING TO LENGTH OF SERVICE

Serial No	Itemization	Total columns 4-10	Below one year	1-2	2-3	3-5	5-10	10-25	25 and over
1	2	3	4	5	6	7	8	9	10
1	Laborers								
2	Engineering and technical workers								

Table 5/IV shows the results of prewar studies in the length of service of workers in their last place of employment.

In some enterprises workers are grouped according to the department in which they work. For example, in an enterprise of the metals industry workers are divided into those working in the foundry, forge, nickle plating, etc. In an enterprise of the textile industry they are divided into those employed in spinning, weaving, finishing, etc, or according to the types of operations performed. In the coal industry, for example, among workers at the face of the mine the following are distinguished.

1. at the coalface
    a. preparatory work
    b. sorting
2. at other face operations such as filling in
    a. dry fill
    b. liquid fill

Of special importance is the statistical study of employment by the occupation of the workers or the so-called subjective occupation. Within this area workers are grouped according to their trade and according to their specialties.

As an example, we cite below an excerpt from the nomenclature of occupations.

TABLE 4/V

Trade	Name of Occupation	Department of trade number	Department of trade	Specialty number	Specialty
[1]	[2]	[3]	[4]	[5]	[6]
11	Textile engineer	1110	spinning	11101	cotton
				11102	flax
				11103	jute
				11104	wool
		1111	weaving	11111	cotton
				11112	wool
				11113	silk
				11114	special bast
				11115	artificial silk
		1112	finishing	11121	bleaching, finishing and

[1]	[2]	[3]	[4]	[5]	[6]
					dyeing of cellulose fibers
				11122	dyeing of animal fibers
				11123	printing

In view of the lack of an exhaustive, detailed, and universally binding nomenclature of occupations, no state-wide statistical studies in this field are being conducted at present. Studies of this kind are however conducted in some types of organizations or as questionnaire studies.

In grouping workers by occupations, one distinguishes the basic occupations or the occupations which have a decisive influence on the production of a given industry, for example, smelters in metallurgy, weavers in the textile industry, etc, and the so-called joint occupations appearing in various branches of industry, such as a stoker, chauffeur, etc.

In the Soviet Union statistical studies of workers by occupation is done once a year. For the 1951 study, as of 1 August 1951, 453 occupations were listed for the workers and apprentices.

Within the framework of some occupations workers can also be grouped by their qualifications on the basis of their classification category or the index of qualification.

The measure of the average qualification of workers is the average of their classification category which is computed as the arithmetic mean of the classification category against the total number of workers of this category.

Classification category	I	II	III	IV	V	VI	VII	VIII
No of employed	20	30	40	50	40	40	30	20

The average classification category equals

$$\frac{(1x20)+(2x30)+(3x40)+(4x50)+(5x40)+(6x40)+(7x30)+(8x20)}{20+30+40+50+40+40+30+20} =$$

$$\frac{20+60+120+200+200+240+210+160}{270} = \frac{1,210}{270} = 4.41$$

The problem of constantly increasing the occupational qualifications is closely associated with the growth of the living standard of the population, since higher qualification brings with it higher pay.

In line with the principle set out by the Six-Year Plan law, it is necessary to increase the number of trade school graduates to over one million, and, especially during the period of training cadres for industry and transportation, it is necessary to reach the figure of 580,000 graduates. Over and above that, it is necessary to train in qualifying courses of grade I and II 336,000 people, including 244,000 in the technical field and about 146,000 graduates of higher schools of learning.

In the Soviet Union in accordance with the directives of the Fourteenth Congress of the CPSU it was resolved "to increase during 1955 the number of graduate specialists of higher schools of learning for the most important branches of industry, construction, and farming to about twice the figuee of 1950" (Nowe Orogi, Special Number 1952, page 409).

The degree of raising the qualification of workers depends largely on the fulfillment of the plan for intraplant training. The fulfillment of this plan is studied at a central level on the basis of quarterly reports along the lines of Model 4/IV.

MODEL 4/IV

INTRAPLANT TRAINING

Position No	Itemization	Number of Trained Workers plan	fulfillment
1	2	3	4
A1	Total (items $B_3+C_6+D_{15}$)		
2	including workers		
B3	Teaching of trade (positions 4+5)		
4	Individual		
5	In groups		
6	Raising of qualification (positions 8-13) including workers		
8	in minimum technical course		
9	in specialization courses		
10	in production technique courses		
11	in teaching new trade		
12			
13			

14 Number of juveniles in column 4, position 1:______________________

TABLE 5/IV

LENGTH OF SERVICE OF WORKERS AS OF JANUARY 1934, IN PERCENTAGES

Itemization	Worked in Their Last Place of Employment ______ consecutive years								Median length of service
	under 1 year	1-2	2-3	3-4	4-5	5-10	10-15	15 and over	
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
A. By Branch of Industry									
Total	30.0	15.0	8.5	6.8	6.0	19.3	10.6	3.8	2.6
Men	29.0	15.0	8.6	6.4	5.9	18.0	11.2	5.0	2.8
Women	30.1	14.9	8.4	7.5	6.3	21.5	9.6	1.7	2.6
Industries:									
Mineral	47.5	19.1	7.0	5.9	4.4	10.1	4.3	1.7	1.1
Metals	29.9	14.9	9.4	7.9	6.6	18.8	8.5	4.0	2.6
Chemical	13.1	8.9	8.2	6.3	9.4	30.2	16.4	7.5	5.7
Textile	31.6	16.8	8.9	7.2	5.1	16.1	12.5	1.8	2.2
Paper	12.2	8.0	6.8	7.5	8.3	29.6	18.6	9.0	6.2
Leather	21.0	16.9	14.4	6.9	6.6	18.8	8.7	3.7	2.6
Food	17.0	3.9	6.2	6.1	6.7	33.4	13.1	8.6	5.8
Lumber	44.6	20.3	9.5	5.9	4.6	10.2	3.5	1.4	1.3

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Clothing	50.7	17.0	8.2	4.5	4.6	11.5	2.2	1.3	1.0
Construction	48.5	13.6	6.5	4.0	2.5	11.6	7.6	5.7	1.1
Polygraphic	21.8	13.0	9.9	9.5	10.9	21.1	9.0	4.8	3.6
			B. By Size of Plant						
Plants employing									
up to 49 workers	34.3	16.7	9.8	7.5	6.5	15.3	6.7	3.2	1.9
50-199 workers	34.6	17.1	9.3	7.2	5.9	14.9	6.9	4.1	1.9
200-999 workers	29.1	13.8	7.6	6.1	5.5	21.5	11.5	4.9	2.9
1,000 and over	23.0	12.3	7.8	6.8	6.6	24.7	16.5	2.3	4.0
			C. By Age of Plant						
Plants existing									
Below 1 year	100.0	x	x	x	x	x	x	x	0.5
1-2 years	41.3	58.7	x	x	x	x	x	x	1.1
2-3 years	47.6	23.8	28.6	x	x	x	x	x	1.1
3-4 years	32.0	25.1	17.5	25.4	x	x	x	x	1.7
4-5 years	57.5	16.6	8.3	8.8	8.8	x	x	x	0.9

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
5-10 years	31.1	17.4	8.7	8.2	8.8	25.8	x	x	2.2
10-15 years	30.3	16.8	11.5	7.0	6.9	19.4	8.1	x	2.3
15-30 years	29.0	13.3	7.5	7.4	6.2	22.8	10.8	3.0	3.2
30 and over unknown	24.2	13.8	7.9	6.5	5.9	20.1	14.9	6.7	3.6
number of years	33.9	11.3	7.8	5.9	5.2	19.8	13.1	3.0	2.6

Source: Same as Table 2/IV.

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In the Soviet Union workers are also grouped by the level of their education, and the educational data are studied in connection with the age of the workers according to the following age groups: below 26 years of age, from 26 to 50 years of age, and 50 years or above.

In order to obtain as complete a picture as possible of workers employed in industrial plants, workers are grouped according to social origin, party affiliation, family status, etc.

In current statistical reports, workers are also grouped by percentage of their norm fulfillments, with the specification of the number of excelling workers or according to their earnings.

5. Shifting of Workers

In order to show changes occurring in the employment level as well as the shifting of workers, industrial enterprises file monthly reports according to Model 5/IV.

(See Model 5/IV on Page 156)

This report is a statement of the labor force showing the changes in size of the work force at the beginning and end of the report month in a given enterprise as well as the shifting of employees with the specification of some of the reasons for departure and some sources from which new employees were drawn.

Consequently one should distinguish between the fluctuation in employment, or the change in the average number of employees of a given enterprise, and the fluctuation of employees, or the shifting which results from the hiring and releasing of workers.

MODEL 5/IV

SHIFTING OF EMPLOYEES

Serial No	Itemization	Status at beginning report month	Out during report month total	left voluntarily	In during report month Total	graduates of trade schools	Status at end of report month
1	2	3	4	5	6	7	8
	total employed						
1	workers						
2	including in industrial group						
3	engineering and technical workers						
4	administrative and office workers						
5	apprentices						

A report submitted according to Model 5/IV deals exclusively with external shifts of employees, that is, the hiring of workers from outside and their release from the enterprise, but it does not concern itself with internal moves, that is the moving of a worker from one plant, division, or department to another within the same enterprise.

Cases of transfer of a worker from one subgroup to another which involve a change in the work agreement between the worker and the enterprise (for example, the transfer of a laborer to the engineering and technical or to the administrative subgroup or a transfer of an apprentice to the workers subgroup) is treated as the release of one and the hiring of another worker and are included in the data on the shifting of workers.

Neither does this report include the shifting of a student temporarily hired by the enterprise for the vacation period or diploma practice.

The usual presentation of statistical data concerning the level of employment in several consecutive periods does not give a proper picture of the shifting of employees. This is illustrated by the following example.

Month	Employment Level on the first day of the month	Hired	Released
January	1,000	600	590
February	1,010	50	5
March	1,055		

It would appear from the usual presentation of the level of employment on the first day of January and February that the movement of employees was insignificant, amounting to barely 1% (1,000 and 1,010). Actually

however the shifting during January was very large, since 600 new workers were hired and 590 let go. The case for February is entirely different. Despite the increase of 5% (1,010 and 1,055) in the level of employment between 1 February and 1 March, the shifting of employees during February as compared to January was relatively small, since only 50 new workers were hired and barely 5 were let go.

The above example shows that statistical data on the level of employment do not reflect the shifting of workers, and it is necessary to aim for data which would reflect the number of hired and released workers, or the so-called workers turnover.

Absolute figures regarding the number of hired or released workers not in conjunction with data regarding the level of employment for the same period does not give any basis for analysis of the turnover in the labor force or for the comparison of labor shifting tension in various enterprises or in the same enterprise during various periods of time. Dissociated information that an enterprise released, for example, 100 workers during the month, does not tell us much about the tension of the shifting of employees in the enterprise. It is a very large shift, if the enterprise employs a total of barely 200 workers, but is insignificant if the average employment of the enterprise is 10,000 or 15,000.

For this reason, special indices are used in statistical practice which together with the relative figures characterize the intensity of the shifting of workers in relation to the employment level of the enterprise.

In accordance with the 1953 instruction of GUS concerning heavy and medium industry, so-called coefficients of labor turnover were computed as (a) coefficient of hiring turnover, and (b) coefficient of

releasing turnover. The turnover coefficient is computed as the percentage ratio of the number of workers hired or released in a given month to the total number of employees of the enterprise as of the last day of the preceding month.

The turnover coefficient of hiring and releasing is computed in relation to the total number employed at the beginning of the report period and not in relation to the average number of employed during the period. The point is that the average number of employed during the report period is affected by the number of both hired and released workers and cannot, for this reason, serve as the reference unit.

Example:

Total Number of Employed on 31 May	Hired in June	Released in June	Worker's Turnover Coefficient for Hiring	Releasing
1,000	50	70	$\frac{50}{1,000} \times 100 = 5\%$	$\frac{70}{1,000} \times 100 = 7\%$

It is noteworthy that in addition to the hiring and releasing turnover coefficients, it is also possible to compute the coefficient of overall workers turnover as the percentage ratio of the sum of hirings and releasing to the total number of employees. In the example given above, the overall turnover coefficient amounts to $(50+70) \div 1,000 = 0.124$ or 12%. The information value of this coefficient is very limited however, since it describes more the amount of work in the personnel department of the enterprise than the tension of hiring and releasing shifts, which is the essential point.

Some statisticians compute also the gross turnover of workers, as the percentage ratio of the sum of employment levels on the first day of the month and the number of employees averaged to the average level of employment during the report month.

Example:

Employment level at beginning of month	1,500 workers
Hired	300 workers
Released	100 workers
Employment level at end of month (1,500+300)-100 =	1,700 workers
Average employment level during month (1,500+1,700)÷2 =	1,600 workers
Gross turnover coefficient (1,500+300)÷1,600x100 =	112.5%

The gross turnover coefficient shows that 12.5% more workers participated in the activity of the enterprise during the month than is shown by the average employment level.

It is true that each case of hiring or releasing of an employee may be considered as a damaging phenomenon. Very often the shifting of a worker is economically most justified and useful, for example when a sugar factory releases the seasonal workers at the end of the season, or when a worker is released for military service, or for retirement, social advancement, transfer to another job, etc.

Similarly not every case of hiring a new worker is caused by the necessity to replace a released one. Very often new workers are hired in connection with expanded activity of the enterprise. Indeed the growth in employment is a characteristic trait of Poland's national economy which develops on the principles of the socialist everincreasing scale.

The above examples show that the damaging phenomenon is not the shifting of work force size but the flow of the workers, or the replacement of released workers by newly hired ones.

The flow of labor disorganizes to a great extent the work of Poland's enterprises. It is especially responsible for the lowering of the general level of productivity and quality of production, for the increase in operating costs, accidents, excessive consumption of materials and equipment, and the increase of additional costs connected with the training of newly hired workers.

The measure of the absolute magnitude of the flow of the labor force is the number of workers replaced in a given enterprise during the period under study, or the lesser of the 2 figures, number of hired and number of released workers.

One can observe the flow of labor by the month, but of much more informative value are the statistical studies of quarterly or yearly periods. Replacement of workers who left the plant does not always take place during the same month and for this reason the definition of flow on the basis of data for one month or a quarter does not give a true picture of labor flow.

Example:

Months	Number of Employed at beginning of month	Hired	Released	Replaced
July	1,000	6	126	6
August	880	136	8	8
September	1,008	10	10	10
Total for third quarter	963	152	144	144

The above example shows that, were we to study the total replacement for each month separately, we would say that it was very small. Looking at it for the total quarter however, we reach an entirely different conclusion. The reason for such a marked difference between the magnitude of replacement for the quarter and during the individual months lies in the fact that the replacement of workers who left in July occurred only in August, a fact which creates the illusion of an insignificant replacement in July. (For this reason the number of workers replaced for the quarter does not equal the sum of the workers replaced during each of the months during the quarter (that is, 6+8+10 = 24), but to the lesser of the 2 figures, the hired or released for the total quarter, or 144)

It is quite clear that the total flow for the year will be equally larger than the sum of the flow indices for the 4 quarters and considerably greater than the sum of the indices for the 12 months.

As in the case of labor turnover studies, and for the same reasons, we do not limit ourselves to the study of the absolute magnitudes of flow, but we also study its intensity, that is, the percentage ratio of the number of replaced workers to the average crew level in a given period. In the example cited, the percentage flow coefficient amounts to the following.

Month	Flow Coefficient
July	-6÷1,000 = 0.6%
August	-8÷ 800 = 0.9%
September	-10÷1,008 = 0.9%
For the quarter	-114÷1,000 =14.9%

In order to obtain a correct picture of the flow it is necessary to compute the flow for the various departments of an enterprise, and within the departments for the various occupations, and not for the entire enterprise jointly.

Example:

Departments	In	Out	Replaced
Spinning	10	-	-
Weaving	-	20	-
Dyeing	8	2	2
Storeroom	12	4	4
Total	30	26	6

The total number of replaced workers for the entire enterprise is 26, but actually only 6 workers were replaced, 2 in the dyeing department and 4 in the storeroom.

For the same reasons it is necessary to study the flow for the various occupations within the same department. It may happen that 8 dyers were hired and 2 scrubbing women released, in which case there was really no replacement as would have been recorded in the preceeding example.

The mean flow coefficient for several enterprises, and within the framework of the enterprises for several groups of employed, occupations, etc is computed sas the arithmetic mean of the individual coefficients, weighed against the average crew level for the period studied.

Example:

Enterprise	Employed at beginning of month	In	Out	Replaced	Flow Coefficient in percentages
A	1,000	120	240	120	12
B	1,000	60	40	40	4
C	2,000	400	200	200	10
Total	4,000	580	480	360	9

The mean flow coefficient for enterprises A, B and C is

$$\frac{(0.12x1,000)+(0.04x1,000)+(0.10x2,000)}{1,000+1,000+2,000} = 9\%$$

We will obtain the same result if we will divide the total number of replaced workers (that is, 360) for enterprises A, B, and C by the average of their crew levels (that is, 4,000).

The mean flow coefficient for the various occupations within the enterprise should be computed in a similar manner.

An essential condition for the application of statistical methods in the analysis of the flow of labor is the maintainance of exact records for the shifting of employees with a full accounting of the reasons for this shifting and accurate definition of the workers occupations.

Statistical studies of labor turnover in Poland were started with the questionnaire commissions studies of the conditions and costs of production and exchange. These studies were limited exclusively to the metallurigcal field during 1925-1926, ("Report of the Questionnaire Committee," [Metallurgical Industry], Vol XIII, pages 183,184).

At the beginning of 1931, GUS commenced the systematic study of

the problem of labor turnover in the heavy and medium manufacturing industry without considering the reasons for the turnover. (Pruss, S., "Workers Turnover," Statystyka Pracy 1931, No 4, pages 377-379)

In the second quarter of 1932, a questionnaire study was conducted in 298 larger industrial plants in relation to the turnover of mental workers in the manufacturing industry during the years 1927-1931. The results of this study are shown in Table 6/IV.

TABLE 6/IV

TURNOVER OF MENTAL WORKERS IN THE MANUFACTURING INDUSTRY

1927-1931

In Percentages

Year	For 100 Mental Workers employed 1 January		Percentage of crew replacement
	In	Out	
1927	19.7	9.4	9.4
1928	24.4	12.0	12.0
1929	19.4	13.4	13.4
1930	11.6	16.0	11.6
1931	10.9	19.3	10.9

Source: Derengowski, J., "Turnover of Industrial Workers in the Manufacturing Industry during the Years 1927-1931," Statystyka Pracy 1932, pages 249-253).

From these data it is easy to note the results of the crisis, which, starting in 1929, was responsible for the large decrease in the percentage of hirings and the growth of the percentage of releases.

Starting with 1933, data regarding the labor turnover for the individual years were published in Labor Statistics.

6. Analysis of the Employment Quota Fulfillment

Supervision of the employment quota fulfillment is conducted monthly on the basis of reports submitted by enterprises and supervisory units on forms according to Model 1/IV shown on page .

The study of employment quota fulfillment does not consist of the simple comparison of the planned and actual employment of the enterprise independently of data concerning the production quota fulfillment. As is known, the employment quota is strictly associated with the production quota and is established on the basis of the quantity of production expected. Therefore the examination of the employment quota cannot be dissociated from that of the production quota. Therefore one cannot limit oneself to a comparison of the planned and actual employments, and it is necessary to compute the so-called index of the relative quota fulfillment employment.

One computes this index in such a manner that the planned number of employees is corrected by the coefficient of production quota fulfillment. It is computed as the ratio of the actual number of employed to the corrected planned number.

Example

Itemization	Unit of measure	Plan	Fulfillment	Coefficient of plan fulfillment
Value of production	1,000 zlotys	1,000	800	0.8
Employment	worker	200	180	0.9
Employment corrected for the coefficient of production quota fulfillment	worker	160	180	1.125

It is seen from the above example that the enterprise apparently lowered the number of employees by comparison with the plan by 10% ($\frac{180}{200}$ x 100). However, as soon as we correct the planned number of employees by the coefficient of production fulfillment (200x0.8=160), it is clear that in reality the planned limit of employment was exceeded by 12.5% ($\frac{180}{160}$x100 = 112.5%).

Study of employment plan fulfillment in an enterprise does not limit itself to the overall number of employed but is extended to specific groups or subgroups of employees, since sometimes overall successful fulfillment data cover excesses in some subgroups, a fact which should definitely be evaluated as negative.

For example, let us assume that an enterprise fulfilled by 100% its production and employment quotas. The employment fulfillment situation by specific occupational subgroups presented itself as follows.

Serial No	Itemization	Average Record Number of employees planned	actual	% Quota fulfillment
1	Laborers	100	90	90
2	Engineering and technical workers	10		
3.	Administrative and office workers	7		
4	Apprentices	10		
5	Maintainance workers	4		
6	Guards	6		
Total		137		

As is to be seen from the above example, behind the 100% overall employment fulfillment quota there are hidden facts of flagrant over-fulfillments in administrative and office help as well as maintainance workers. At the same time, on the positive side of the evaluation is the fact of 100% production fulfillment with an employment quota fulfillment of only 90%.

One should note that the corrected employment quota fulfillment index is to be computed first of all in relatinnship to the laborers, since it is their work that directly affects the magnitude of fulfilled production.

Of great significance is the study of the employment fulfillment quota in an enterprise by specific production departments (divisions). Here too it is important that the positive aspects of the plan fulfillment not hide excesses in some departments at the cost of other, excelling ones.

On the basis of existing reporting procedures in the field of employment quota fulfillment it is possible to compute total employment dynamics indices as well as those for specific groups and subgroups.

From statistical data it is possible to compute the monthly employment indices, taking as the basis of the index the actual number of employed during the preceding month (chain index) or for the same month of the preceding year. It is also possible to compute the employment indices for the period from the beginning of the year to the end of the report period in relation to the same period for the preceding year.

In computing the above-mentioned indices of employment for specific subgroups of employees the preservation of the overall comparability is to be borne constantly in mind, since with change in methods changes also occur in the scope of categories of employees, such as maintainance workers, laborers, etc, things which are likely to distort the indices.

The yearly employment dynamics index is computed as the ratio of the average monthly employment during the year under study to the average monthly employment for the basic year. The average monthly employment for the year is computed by dividing the sum of the number of employees for each month of the year by 12, and the number of employed during the month is defined as the monthly average, or for a given day of a month.

In the postwar period GUS published the employment index for laborers in industrial plants. This index is presented in Table 7/IV.

TABLE 7/IV

EMPLOYMENT INDEX

1947	1948	1949	1949											1950
Monthly Average			II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	I
100	113	130	122	123	124	125	127	129	131	134	141	143	139	139

Source: Wiadomosci Statystyczne, No 4, 1950, GUS, page 3.

The index for 1947 in this table was computed on the basis of the average employment for the month with the exclusion of the central administrations of the coal and metallurgical industry, for which the basis of computation was the employment as of the last day of the month. The index for 1948 was computed on the basis of the employment level for the last day of the month, and both 1947 and 1948 figures did not include

employment in the polygraphic industry. The indices for 1949 and for 1950 were computed from the employment level on the last day of the month with the exception of the central administration of the coal industry for which the average was obtained from the average number of employees during the month.

In view of the fact that the most important indices of the Six-Year Plan were computed on the basis of the data concerning the starting point year of 1949, GUS neglected to publish the employment index based on 1947 and started the publication of the index during the Six-Year Plan based on the year 1949 (See Table 8/IV).

TABLE 8/IV

INDEX OF EMPLOYMENT IN INDUSTRY (1949 = 100)

Itemization	1947	1948	1949	1950	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
	monthly averages															
Total	85.1	91.8	100	115.3	107.0	108.0	119.1	111.8	113.5	114.4	116.3	117.9	119.7	121.6	122.6	123.3
Labor	86.1	92.1	100	114.2	106.7	107.6	109.6	111.1	112.6	113.6	115.0	116.2	118.2	120.1	121.0	121.6
Mental workers	77.4	89.7	100	122.9	109.1	110.7	113.9	116.4	118.8	121.0	125.8	128.8	130.3	133.1	134.5	136.2

Note: excluding sugar and potato industries.

Source: <u>Wiadomosci Statystyczne</u>, No 5, 1951, GUS, page 1.

From the note to Table 8/IV it is to be seen that in computing the monthly employment indices for 1950, the employment in the plants of the sugar and potato industry were excluded because of the seasonal nature of employment in these plants.

V. WORKTIME STATISTICS

I. Osipow

1. General Concept of Worktime Statistics

Worktime statistics constitute an indispensable complement to employment statistics studies. Employment statistics data concerning the number of workers do not give a complete picture of the utilization of the labor force supply employed in industry. From data showing, let us say, that the average number of employees of an enterprise in April was 500, one cannot compute exactly how many working hours the laborers expended during the month. Roughly it could be said that 500 workers worked 25 days 8 hours daily for a total of 500x25x8 = 100,000 man-hours. It should be noted however that not all workers on record were actually at work during the entire month. Some of them may have been absent because of vacations, illness, attendance at training courses, etc, and others may have worked overtime. Hence, the conclusion that, in order to obtain a true picture of the actual utilization of the working force by the enterprise, one cannot limit oneself to the result of employment statistics studies alone but must explore further data concerning the statistics of worktime.

In order to bring into light and put into use the reserves contained in incomplete utilization of working time, it is necessary to conduct systematic statistical studies which would show the reserve worktime supply of an enterprise as well as the degree of utilization of this supply.

The conduct of these studies also is essential because the planning of production, employment, and wages is directly connected with the planning of worktime. It is an essential forerunner of the reality and precision of the entire technical, industrial, and financial planning of the enterprise.

The primary problem of worktime statistics is therefore the supervision of the worktime quota fulfillment and the supply of data essential to the planning of worktime utilization.

In view of the fact that labor is the basic factor of production, the essential need arises to study the degree of utilization of possessed worktime supply. Associated with it are studies of the structure of worktime and degree of utilization by work day, month, or year.

Statistical data concerning worktime in industry in the Polish People's Republic indicate an ever improving utilization of worktime. One can gain a picture of these achievements, for example, by the presentation of 2 dynamics indices, employment and put-in worktime. A more rapid growth of the put in worktime index than the employment index certifies to a better utilization of existing labor supply. In 1950, for example, the index of employment growth for labor in Polish industry amounted to 114.2 as compared to 100 for 1949, but the index for put in man-hours was 116.9 (adjusted index)(Wiadomosci Statystyczne, No 7-8, 1951, GUS, page 3).

Of an entirely different character are bourgeois statistical data concerning the worktime in industry in capitalist countries. These data show, on the one hand, an incomplete utilization of the existing production force, characteristic of the capitalist system, and the phenomenon associated with it of partial unemployment, where employees work one or several days a week only.

On the other hand, these data show an exploitation of the working class by excessive prolongation of the workday, by work 7 days a week, etc.

This also explains the fact that the subject matter of bourgeois statistical work is different from that of the people's democracies and the USSR.

As an illustration we submit Table 1/V showing worktime in the manufacturing industry in pre-September Poland.

TABLE 1/V

WORKERS IN THE MANUFACTURING INDUSTRY EMPLOYED IN PRODUCTION ACCORDING TO DAYS WORKED PER WEEK DURING 4-10 DECEMBER 1932

Workers employed ____ days per week

1	2	3	4	5	6	7
3,774	10,421	41,453	37,345	150,319	40,837	14,135

Note: One holiday.

Source: Statystyka Pracy 1933, Yearbook XII, Section 1, page 28.

2. Measures of Worktime

In order to conduct statistical studies regarding worktime, it is necessary to establish units of measure with the aid of which it will be possible to measure the time put in as well as the time not put into production. It is accepted that the quantity of labor expended by workers in an enterprise is measured by its duration. Knowing for instance that during February a worker put in 190 hours and in March 200, we come to the conclusion that the workers expanded more labor in March than in February. The duration time of work is measured in units of time, such as hour, day, month, and year. Regarding this subject Marx wrote the following.

"The quantity of labor itself is measured by its duration, and the worktime in turn has a scale in defined time units, such as hour, day, etc." (Marx, K., Kapital, Vol I, 1951, Book and Knowledge, page 41).

The quantity of work expressed in units of time Marx calls the "extensive measure of work."

In statistical study practice, the worktime of laborers is measured

basically in man-hours or in man-days. By a put-in manhour is meant the work put in by one laborer for the duration of one hour. Similarly by an omitted manhour is meant the work not put in by one worker for the duration of one hour. The put in worktime in man-hours is computed therefore as the product of the number of workers and the number of hours put in by them. If, for instance, 3 laborers worked 5 days at 8 hours a day during the week and 6 hours for one day (Saturday), then the time put in by them is

$$3x(5x8)+(1x6) = 138 \text{ man-hours.}$$

If during the period under study one of these workers worked overtime for 2 hours each day for a period of 4 days, then these hours should be added to the total man-hours as follows:

$$(4x2)+138 = 146 \text{ man-hours.}$$

We further distinguish normal man-hours, that is, man-hours worked during the regular workday, and overtime man-hours worked over the normal workday.

As is known there is a legally established number of work hours during the workday. As a whole, workers in industrial enterprises work an 8-hour day (Saturday 6 hours), with the exception of certain plants in which a shorter workday prevails (7-6 hours) due to difficult or health damaging working conditions as well as with the exception of some groups of workers (for example, adolescents) which benefit from a shorter workday. Time worked within the normal legal workday is considered normal worktime. If then a worker employed at a plant working a normal 6-hour day worked 8 hours during the day, then only 6 man-hours are considered normal worktime and the additional 2 hours are considered overtime man-hours.

As normal workhours are considered also any stoppage time, not of the fault of the workers, due to the lack of raw materials, orders, power stoppage, machinery breakdown, etc.

The inclusion of such stoppage hours in the normal workhours is based on the fact that during the stoppage the worker is present on his job and is not working through no fault of his own.

Depending upon its duration, one distinguishes whole-day or whole-shift stoppages and current or intrashift stoppages, depending on whether the worker reporting for work did not work the whole day (shift) or only part of the normal workday (shift). A separate kind of stoppage is the so-called 'utilized stoppage.' By a 'utilized stoppage' is understood the placing of the worker at another post temporarily for the duration of the whole-day or current stoppage. In statistical reporting 'utilized stoppages' are not treated as stoppages and the time worked for their duration is considered normal worktime.

In current statistical reporting, reporting units submit separate data regarding stoppage man-hours. These data reveal facts of poor organization of work in the enterprise, especially when they are grouped by causes (for example, lack of power, lack of raw materials, lack of tools, accidents, lack of orders, etc). One should note that in view of the varying production and conditions of work, the classification of the stoppage causes is not uniform for various enterprises.

In order to bring fully to light the reasons for the poor organization of work, one should really specify in the normal worktime also the 'utilized stoppages,' since they also come within the scope of poor organization of work, for example, the fact that a skilled lathe operator is used as a loader or in some other unskilled labor during the stoppage.

Detailed study of stoppages and their analysis aids in the struggle against such waste of worktime.

Normal man-hours include all hours worked by stokers, machine drivers, chauffeurs, and other straight salary workers, including the hours worked by them overtime on Sundays and holidays because of the specific nature of the work of the above workers.

By overtime man-hours are understood the hours worked by the workers over and above the legally established workday in a given enterprise as well as the hours worked during nonworkdays such as Sundays and holidays. However, if a worker who took time off during the week for personal reasons with the understanding that he would make up the time during overtime hours or on Sunday or on a holiday, then those hours are considered regular and not overtime hours. Similarly, when a man works on normally overtime hours with the understanding that he will get time off during regular working time, these hours too are considered regular man-hours.

Overtime hours include overtime resulting from continuous operation. These, according to GUS instructions, are the hours of work performed during the normal (basically 8-hour) workday, but falling, as a result of continuous operation, on a Sunday or holiday. As is known, Saturday is a short (6-hour) workday. If, then, a plant operates on a Saturday as well as other days of the week on a 3 8-hour shift schedule, these 2 hours falling on a Saturday should be treated as overtime hours as a result of continuous operation, unless workers receive in exchange for them free time during normal work hours. It is worth noting at this point that overtime hours due to continuous operation are paid at special, higher scale rates.

Another measure of worktime, besides the man-hours, are man-days. A man-day is understood to be one day spent at work by one worker, regardless of the effective number of working hours on this particular day. It does not matter if the worker was late, if he did not work for several hours during that day, or if he worked an abnormally long day (including overtime), since in each of these cases it is considered that the man put in a man-day. The mere fact of a worker presenting himself for work, regardless of the actual number of hours worked, decides the creation of the man-day. The number of worked man-days is computed, in an analogous manner to man-hours, by multiplying the number of workers by the number of days put in by them.

Also considered as man-days are days during which a worker spent in service delegation or doing assigned work outside the premises of the plant where he does his regular work.

By comparing the 2 unit measures of worktime the man-hour and the man-day, it is clear that the man-day is a less accurate measure of the worktime. In practice however worktime is computed in man-days usually in those cases where worktime is not recorded by the hour. This manner of worktime computation is also necessary in computing the average daily productivity and the daily payroll which will be discussed in later chapters.

The man-day as a unit of worktime is applied in the coal and lumber industries as well as several other branches of industry.

The worktime of engineering and technical workers, of administrative and office workers, as well as in maintainance and guarding is computed in man-months. By a man-month is meant the work of one worker during one month. Computing the overall number of put in man-months, it is assumed that the average recorded number of workers in a plant on a given

month equals the number of put-in man-months. If then the average recorded number of workers during a given month amounts to 100, one may assume that the number of put in man-months was also equal to 100.

In order to compute the level of the average monthly productivity of one worker, it is sufficient to divide the monthly production by the average recorded number of workers in a given month. We then obtain the production per one put-in man-month. However, in computing the hourly or daily productivity, it is necessary to divide the monthly production by the total of all man-hours or man-days put in during that month.

Besides the units of measure mentioned above, worktime can be measured by much smaller units, hence in minutes or seconds. In our normal statistical practice worktime is recorded only in hours and days. Measuring worktime in minutes and seconds finds its application in the computation of technical norms, in obtaining so-called photographs of worktime or in time studies.

3. Amount and Structure of Worktime

The amount of worktime describes the supply of worktime possessed by an enterprise as well as the manner of its utilization.

The supply of worktime which an enterprise has is defined by the so-called nominal worktime which is computed in such a manner that the average recorded number of workers for all workdays during the period under study is multiplied by the number of workdays as well as by the normal daily workhours taking into account the shorter worktime on Saturday but not taking into account the shortened worktime of nursing mothers, adolescents, or of workers employed in hazardous occupations. For example, in July 1953, of a total number of 31 calendar days there were 5 nonworkdays (4 Sundays and one holiday). Therefore 31-5 = 26 workdays.

Of these 22 were 8-hour days and 4 were 6-hour days (Saturdays). Let us assume, that the average recorded number of employees for all workdays in July amounted to 200. From these data we can figure that the nominal worktime of the enterprise during July amounted to 22 days times 200 workers times 8 hours plus (4 Saturdays times 200 workers times 6 hours) = 35,200+4,800= 40,000 man-hours. Nominal worktime is therefore defined as the maximum worktime which is possible for a given crew to put in during normal hours.

Some textbooks advocate the computation of the nominal worktime on the basis of the calendar worktime, which is computed in such a manner that the average recorded number of workers for all calendar days of the period under study is multiplied by all calendar days of that period. The nominal worktime is obtained by subtracting from the calendar worktime man-days (or man-hours) which falls on the average recorded number of workers on nonworking days.

This method was justly criticized in Soviet literature by M. Iljewski Vestnik Statistiki, No 6, 1952, pages 27-38), because the application of this method leads to erroneous results.

The average number of workers on record in the computation of calendar worktime pertains to all calendar days of the period under study and not only to the workdays in relation to which nominal worktime should be computed. The fault of this method is illustrated in the following example.

Days of Week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sun	Total Man-days
Recorded No of workers	20	20	20	20	25	35	35	175
No of workers at work	20	20	20	20	25	35	--	140

As is seen from the above example, the overall calendar worktime amounts to 175 man-days. The average recorded number of workers for all calendar days during the period under study amounts to 175 ÷ 7 = 25. The number of man-days falling on nonworkdays, that is, Sundays, amounts to 25x1 = 25. The nominal working time is therefore 175-25 = 150, which is definitely wrong, the actual nominal work time amounting to only 140 man-days.

From the standpoint of utilizing the available worktime resources, the nominal worktime is generally grouped into on-the-job and absentee time.

The time worked during overtime hours is not part of the nominal worktime, though current statistical practice includes overtime in on-the-job time. On-the-job time also includes idle man-hours.

The structure of absentee time is studied, in current statistical procedure, according to the causes of absence. Classification of these causes is uniform for all industrial enterprises and is presented on the report form for absentee worktime.

FORM 1/V

ABSENTEE MAN-HOURS IN THOUSANDS

No	Itemization	In the Industrial Group	
		For report month	From the beginning of the year to the end of report month
[1]	[2]	[3]	[4]
1.	Total absence (lines 2-10)		
	Including:		

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[1]	[2]	[3]	[4]
2.	Rest vacations		
3.	Emergency leaves		
4.	Delegated to social work, army maneuvers, courses, 'Serve Poland' camps		
5.	Leaves for study		
6.	Shortened worktime		
7.	Medically certified illness		
8.	Maternity leaves		
9.	Other excused absences		
10.	Unexcused absences		

By rest vacations are meant vacations granted as a result of the law of 16 May 1922 regarding vacations for workers employed in industry and trade as changed by the law of 20 March 1950.

Emergency leaves cover omitted man-hours as a result of paid or unpaid leaves during the working day granted due to special emergencies.

By shortened worktime is meant the paid man-hours taken off by nursing mothers, juvenile workers, or by workers employed in occupations hazardous to health, in accordance with regulations established by the various ministers in accordance with the statute of 17 February 1950 'regarding the shortened worktime of workers employed in work damaging to the health or particularly heavy work.'

By maternity leaves are understood leaves for the purposes of childbirth granted in accordance with the statute on the subject of juvenile workers and women of 2 July 1924, changed by the statute of 28 April 1948.

By unexcused absences are meant the man-hours omitted due to absences not justified in the sense of the statute regarding the preservation of socialist discipline of work of 19 April 1950 and regulations issued on the basis of this statute.

Total worktime for a monthly period is expressed in absolute figures, in man-hours. In order to emphasize the structure of the total worktime, it is necessary to present this also in terms of relative figures, percentages. Finally, in order to arrive at average indices of the total worktime of an employee, it is necessary to divide the various phases of the total in absolute figures by the average recorded number of workers in a given enterprise.

We present below an example of a total worktime report of an enterprise employing 200 men for July 1953, in absolute and relative figures as well as in relationship to one worker.

TOTAL WORKTIME

FOR JULY 1953, IN MAN-HOURS

A. Nominal Work Time	B. I. Time Worked	In man-hours	% In comparison with nominal man-hours	In Man-Hours per employee
[1]	[2]	[3]	[4]	[5]
1. (200 men) (22 days) (8 hrs) = 35,200	1. Total including:	35,00	--	175
	2. Regular	33,000	82.5	165
2. (200 men) (4 Saturdays) (6 hours) = 4,800	3. Idle	1,000	2.5	5
	4. Overtime	2,000	-	10
Total man hours 40,000	II. Absentee Worktime			
	5. Total including:	7,000	17.5	35
	6. Vacations	4,000	10.8	20
	7. Emergency leaves	200	0.50	1
	8. Delegated to social work, army maneuvers, courses, 'Serve Poland' camps	800	2.0	4
	9. Leaves for study	400	1.0	2
	10. Shortened worktime	600	1.50	3

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[1]	[2]	[3]	[4]	[5]
	11. Medically certified illnesses	300	0.75	1.5
	12. Maternity leaves	400	1.00	2
	13. Other excused absences	200	0.50	1
	14. Unexcused absences	100	0.25	0.5

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In computing the structure of worktime in percentages overtime is not taken into consideration.

The percentage share of the various kinds of absentee time is computed equally in relation to the total absentee time (100%) as well as in relation to the nominal worktime.

4. Indices of Worktime Utilization

From statistical data concerning the number of workers and the time worked by them, it is possible to compute certain indices which characterize the degree to which an enterprise utilizes the supply of worktime available to it. By comparing these indices computed for several enterprises during the same period or for one enterprise during various periods, it is possible to evaluate them.

A. Index for the Utilization of the Number of Workers

A basic index is the one for the utilization of the number of workers, which is obtained by dividing the average number of employees present by the average recorded number of employees in a given period. The average number of employees present is obtained by dividing the number of man-days by the number of working days during the same period.

For example, let us assume that during April the workers present put in a total of 5,000 man-days during 25 working days. The average recorded number of employees for April was 250. From these data we can obtain the average number of workers present:

$$5{,}000 \div 25 = 200.$$

The index for the utilization of the number of workers is obtained by dividing the average number of employees present during April by

the average number of employees on record for the same period:

$$\frac{200}{250} = 0.8 \text{ or } 80\%.$$

The method for computing the average recorded number of employees varies in this case from the method used in statistical reporting (see above). In order to have complete comparability of data concerning the average number of employees both present and recorded, it is necessary to adjust them both to the same period, in other words, to divide them both by the number of work and not calendar days during the month.

The method of computing this index by means of an average number of recorded employees based on calendar and not workdays was justly questioned by M. Ilyevski (Vestnik Statistiki, No 6, 1952, pages 22-39), since this method leads to erroneous and frequently paradoxical results.

Example:

Days of the Week	Workers Recorded	Workers Present
Monday	20	19
Tuesday	20	20
Wednesday	19	19
Thursday	18	17
Friday	17	17
Saturday	16	16
Sunday	16	--
Total man-days	126	108

As is seen from the above data, not all employees listed in the personnel records of the enterprise were present during the period under study, since on Monday and on Thursday one worker was absent.

If the average number of recorded emplyees is computed by the method generally accepted in statistical reporting, that is, for all calendar days during the period, we obtain

$$126 \div 7 = 18$$

The average number of present workers equals, as is known, to the number of man-days divided by the number of workdays during the period:

$$108 \div 6 = 18,$$

and the index of the utilization of the number of workers equals

$$\frac{18}{18}-1 = 100\%,$$

which is a factual absurdity since, as is shown from the table, the enterprise was short 2 man-days for the period.

In continuous operations enterprises, in which work goes on without interruption (power plants, foundries, etc), the number of calendar days represents the actual number of workdays. One should however keep in mind that absolute comparability between the average number of workers on record and on the job cannot be obtained until all adjustments have been made for any time exchanges from regular to holiday and Sunday time, and the man-days have been corrected accordingly.

Example:

Serial No	Days of the Week	Monday	Tueday	Wednesday	Thursday	Friday	Saturday	Sunday	Total
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
1.	Total workers on record	35	35	35	35	42	42	42	266
2.	Days omitted by workers availing themselves of time substitution	5	5	5	5	5	5	5	35

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
3.	Corrected total workers on record (1-2)	30	30	30	30	37	37	37	231
4.	Workers present	30	29	28	28	33	34	35	217

In this example the average number of workers on record during the period under study is computed so that the number of man-days omitted by workers availing themselves of time substitution is deducted from the total of recorded man-hours for all calendar days which are at the same time workdays, and the obtained result is divided by the number of calendar days:

$$(266-35)+7 = 231 \div 7 = 33.$$

The average number of workers present for the same period amounts to $217 \div 7 = 31$, and the index of total crew utilization is $31 \div 33 = 0.94 = 94\%$.

B. Index of Workday Utilization

The degree of utilizing the workday is characterized by means of several indices which show the ratio of time actually worked during the day to the normal (statutory) length of the workday. The concept of the normal length of the workday was discussed above.

From data concerning the normal length of the workday of various groups of workers in the enterprise it is possible to compute the index of the average worktime duration within a normal workday by means of the arithmetic mean weighted as in the following example.

Let us assume that an enterprise employs 300 workers who work an 8-hour day, 60 workers who work a 7-hour day, and 40 workers who work a 6-hour day. The average worktime duration within a normal workday is

computed by adding the product of work hours by the number of workers and dividing them by the total number of workers:

$$\frac{(8x300)+(7x60)+(6x40)}{300+60+40} = \frac{2,400+420+240}{400} = \frac{3,060}{400} = 7.65.$$

Hence, in the given enterprise the average worktime during a normal workday amounts to 7.65 hours. We define the degree of time utilization by comparing the actual average worktime with the theoretical one.

The actual average worktime can be computed in 2 ways, as the actual average worktime during regular hours, or as the actual average worktime during the day including both regular and overtime hours.

The average actual worktime for a day for the regular hours only is computed by dividing the number of actual man-hours worked during regular hours by the number of worked days.

For example, let us assume that the total man-hours worked in regular hours during a given period amounts to 37,500 and the total number of worked days to 5,000. The actual average worktime during a workday on regular hours amounts to

$$37,500 \div 5,000 = 7.5 \text{ hours.}$$

Similarly the average actual worktime during a workday (during regular and overtime hours) is computed by dividing the total man-hours for the period including the overtime hours by the total number of man-days worked.

If then in our example the workers put in an additional 2,500 man-hours in overtime, the average actual worktime per workday amounts to

$$(37,500+2,500) \div 5,000 = 8 \text{ hours.}$$

By means of the above measures, it is possible to compute the index of utilization of the average worktime during a normal workday.

(1) Divide the average actual worktime during regular hours by the average worktime during a normal workday. In our example: 7.5÷7.65 = 0.9804 or 98.04%. (2) Or divide the average actual worktime including both regular and overtime hours by the average worktime for a normal day, which in our example amounts to: 8÷7.65 = 1.0457 = 104.57%.

A comparison between the first and second index answers the question as to what degree the overtime work made up for the loss due to absences.

In the cases of planning the average length of workday for various groups and subgroups of workers, it is possible to compute the quota fulfillment index for the average worktime during a workday by dividing the average actual worktime by the planned average for the day.

C. Index of Worktime Utilization for a Week, Month, or Workyear

The index for utilizing the worktime during a workweek is computed so that the average number of actual man-hours during the week under study is divided by the normal number of man-hours during the week, that is, basically by 46 man-hours (5 days times 8 hours plus 6 hours work on Saturday).

The total number of actual man-hours should include regular hours, overtime as well as idle time.

The average actual man-hours during the week under study is computed by dividing the total number of actual man-hours by the average (meaning daily) number of workers for all working days during the week.

The thus computed index of worktime utilization during the week shows the ratio of the average worked man-hours per worker during the week to the normal number of man-hours per worker during the week, that is essentially 46 hours.

In case some workers benefit from a shorter workday, the average number of normal man-hours should be computed by means of the arithmetic mean weighted by the number of workers in the various groups.

In a similar manner are computed the indices for the worktime utilization during the workmonth, dividing the average number of actual man-hours during the month under study by the statutory number of work-days during that month.

The average number of actual worked man-days is obtained by dividing the total number of actual worked man-days by the average (daily) number of workers for all the days during the month, and not by the average recorded number of workers for all calendar days during the month.

The average number of actually worked man-days per one worker is also described as the average actual worktime duration during the work month.

Similarly as in the case of workdays, the average actual length of worktime during the month as well as the index of worktime utilization during the work month can be computed in man-hours.

The same principles apply in the computation of the average actual worktime duration during the workyear and the index of worktime utilization for the workyear.

By dividing the average actual duration of worktime during the work year by the planned duration of worktime for the year, it is possible

to compute the index for the yearly worktime plan fulfillment.

D. Index of Worktime Utilization during Overtime Hours

The separate study of worktime during overtime hours is justified, among other reasons, by the fact that overtime work is paid according to higher rates than regular worktime, which in turn reflects on the operating costs of the enterprise.

In order to describe worktime during overtime hours in relation to total worktime, the following indices are computed. (See Romanov, M. P., Statistika mukomolnoi-krupyanoi promyszlennostii, 1949, pages 224-225)

1. The index of the percentage share of overtime hours in the total worked man-hours, which is computed by dividing the total worked overtime hours by the total number of hours worked (including overtime and idle hours) and multiplying the quotient by 100.

2. The coefficient of overtime hours, which is computed as the ratio of the worktime during overtime hours to the total regular hours worked (including idle time).

The average worktime during overtime hours is computed in order to get an idea of the amount of worktime worked during overtime hours per one worker during overtime hours. This index is computed by dividing the total number of man-hours performed during overtime hours by the average number of only those workers who worked during these overtime hours.

E. Coefficient of Work Shifts

In order to fully utilize their manpower supply industrial, enter-

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prises sometimes work 2, 3, or 4 shifts. The composition of the crews of the different shifts varies, and the worktime may not be uniform for all shifts. The matter of uniform distribution of the workers during the various shifts is of great significance, since the irregular supply of workers during the various shifts, especially those of engineering and technical personnel and that of highly skilled labor, frequently causes the lack of supervision and technical help during the second and third shifts, resulting in lower productivity compared to that of the first shift. This situation therefore calls for a study not only of the degree of utilization of the available labor supply but also of the shifts. (See Resolution No 468 of the Government Presidium of 4 June 1952, relative to insuring the proper composition of crews employed during the second and third shifts in industrial plants (*Monitor Polski*, No A-53, position 782).

The degree of uniform utilization of shifts can be visualized with the aid of the indices of the worktime distribution according to shifts and employee subgroups (Table 2/V).

TABLE 2/V

WORKED MAN-HOURS BY SHIFTS IN PERCENTAGES

(arbitrary data)

Employment Group	Worked Man-Hours in Percentages			
	Total	Shift I	Shift II	Shift III
Labor	100	45	30	25
Engineering and technical	100	60	25	15
Administrative and office	100	75	15	10

The given table illustrates the ununiform distribution of workers for the various shifts, especially those of the engineering and technical as well as the administrative and office groups.

The indexes of man-hour distribution in this table do not show however the compository picture of shift utilization or give a good basis for comparing the degree of shift utilization in various enterprises or in various periods within the same enterprise.

If, for example, at a different period or in another enterprise the 'laborers' subgroup should amount to 40% for shift I, 28% for II, and 22% for III, these data still do not give a basis for confirming which enterprise (or during which period) the degree of shift utilization was greater.

A comprehensive index of the degree of shift utilization is the so-called shift coefficient, which is computed by dividing the total number of worked man-hours in all shifts during regular hours by the number of the man-hours of that shift in which most man-hours were put in.

For example, the total number of worked man-hours for all shifts during a report month was 63,000.

Shift I	worked 30,000	man-hours
Shift II	worked 20,000	man-hours
Shift III	worked 13,000	man-hours
Total	63,000	

The shift coefficient is 63,000÷30,000 = 2.1.

Were the workers, during a certain period, to work in shifts II and III the same number of man-hours as in shift I, then the shift coefficient would equal the number of shifts, that is, 3, or (90,000÷30,000 = 3), and were the workers to work only one shift, then the shift coefficient would be 1, or (30,000÷30,000 = 1).

Speaking in general, with the full utilization of the shifts, the shift coefficient equals the number of shifts, and with the absolute nonutilization of shifts (working only one shift) the shift coefficient equals one.

Therefore from the magnitude of the shift coefficient it is possible to deduce the degree of shift utilization by a given enterprise, since an increased coefficient shows a greater shift utilization.

Some difficulties are encountered in comparing shift coefficients of several enterprises working a varying number of shifts.

For example, let us assume that enterprise A works in 2 shifts, the first one using 20,000 man-hours and the second 10,000. Enterprise B works 3 shifts, using 20,000 man-hours in shift I, and 10,000 in shifts II and III each. The shift coefficient for the enterprise will be

Enterprise A $30{,}000 \div 20{,}000 = 1.5$

Enterprise B $40{,}000 \div 20{,}000 = 2.0$

from the magnitude of the shift coefficients for both enterprises (2 and 1.5) one would surmise that enterprise B achieved a higher degree of shift utilization, which is not the case, since the coefficient for B was computed on the basis of 3 shifts and for A only on the basis of 2.

In order to achieve complete comparability of shift coefficients computed on the basis of varying numbers of shifts, it is necessary to compute the percentage shift coefficients, dividing the coefficients by the number of shifts.

In the given example the percentage shift coefficient for enterprise A amounts to 75% ($1.5 \div 2 = 0.75$) and for enterprise B 66.66% ($2 \div 3 = 0.6666$). This shows that the degree of shift utilization in enterprise B was lower

than in enterprise A and that enterprise A utilized the shifts 75% whereas enterprise B barely 67%.

The thus computed shift coefficient still does not show the complete picture regarding the full utilization of the possessed reserves of labor with relation to shifts. The shortcoming of the coefficient lies in the mere assumption that the number of man-hours of the shift in which the largest number of man-hours were worked constitutes the measure of maximum possibilities of the enterprise. In effect this is not the case, since as is known, the number of man-hours during the shift when most man-hours were worked is considerably less than the nominal number of man-hours possible. In this connection, in order to obtain a better picture of the degree of shift utilization, it is necessary to compute in addition the continuity coefficient. This is done by dividing the number of man-hours worked during the greatest shift by the nominal man-hours of that shift.

If then, in the given example, the nominal number of man-hours in enterprise A for shift I was 25,000, the continuity coefficient will be

$$20,000 \div 25,000 = 0.8 \text{ or } 80\%.$$

In turn, by multiplying the shift coefficient by the continuity coefficient, we obtain the so-called integral shift coefficient.

In the given example this coefficient for enterprise A is

$$0.75 \times 0.80 = 0.60 = 60\%.$$

This means that the enterprise utilized its reserve man-power and shift possibilities only to 60% of capacity.

In order to deepen the analysis of the degree of shift utilization in an enterprise, it is necessary to compute the shift coefficient

separately for each department of the enterprise, so that a favorable situation in one department would not obscure the low degree of shift utilization in the others.

The collective shift coefficient for several enterprises should be computed in the following manner. The total man-hours worked in all shifts in these enterprises should be divided by the sum of the man-hours worked in the various enterprises for that shift in which the maximum man-hours were put in, but not by the sum of the man-hours of that shift in which the maximum number of man-hours were worked in all enterprises.

Example (See Baklanov, G. J., Promyszlennaya statistika, 1953, Moscow, page 190):

(See Example on Page 199)

In the above example it is seen that the largest number of man-hours worked in all enterprises taken together was in shift I, namely 19,000 man-hours (column 2). This figure however is smaller than the sum of man-hours worked in the largest shift in the various enterprises, that is, of 26,000 man-hours (column 6), since the largest shift in enterprise B was the shift II (7,000) and in enterprises C and D the third shift (5,000 and 6,000). Therefore, in order to correctly compute the collective shift coefficient, it is necessary to divide the total worked man-hours in all shifts, that is, 52,000 not by 19,000 (which would give a result of 2.74) but by 26,000; the collective shift coefficient thus amounts to $52,000 \div 26,000 = 2$.

This is the right result, since in such a computation the collective shift coefficient equals the coefficient for the individual enterprises.

Enterprise	Worked Man-Hours					Shift Coefficient
	Shift I	Shift II	Shift III	Total	In largest shift	
1	2	3	4	5	6	7
A	8,000	5,000	3,000	16,000	8,000	$\frac{16,000}{8,000} = 2.0$
B	4,000	7,000	3,000	14,000	7,000	$\frac{14,000}{7,000} = 2.0$
C	3,000	2,000	5,000	10,000	5,000	$\frac{10,000}{5,000} = 2.0$
D	4,000	2,000	6,000	12,000	6,000	$\frac{12,000}{6,000} = 2.0$
Total	19,000	16,000	17,000	52,000	26,000	$\frac{52,000}{26,000} = 2.0$

One should emphasize the fact that shift coefficients indicate only the degree to which shifts have been utilized in relation to existing crews and worktime supply, but they throw no light on the degree of utilizing worktime of machinery, equipment, or productive power of a plant.

Neither do shift coefficients indicate the uniformity of shift staffing, as may be seen from the example given below

Let us assume that an enterprise worked as follows.

	January	%	February	%
In shift I	20,000 man-hours	50.0	20,000 man-hours	50.0
In shift II	17,000 man-hours	42.5	10,000 man-hours	25.0
In shift III	3,000 man-hours	7.5	10,000 man-hours	25.0
Total	40,000 man-hours	100.0	40,000 man-hours	100.0

The shift coefficient for January as well as February amounts to 2, or (40,000÷20,000), whereas the uniformity of shift utilization during these months is entirely different.

VI. STATISTICS OF PRODUCTIVITY

I. Osipow

1. General Concept of Statistics of Productivity

Productivity is one of the most important qualitative indices characterizing industrial activity. Upon productivity depends, as a final result, the magnitude of production produced in an industrial enterprise, hence the degree of meeting the constantly growing material needs of the entire population.

Classical students of marxism-Leninism paid much attention to the problem of productivity. "Productivity," wrote Lenin, "is as a final result the most important and chief factor for the victory of the new social system. Capitalism created a productivity not encountered under conditions of state ownership. Capitalism can and finally will be defeated by the fact that socialism creates a new and considerably higher productivity. (W. I. Lenin, Dziela wybrane [Selected Works], Vol II, 1948, Ksizka i Wiedza, page 574).

The measure of productivity is the number of concrete usable goods per unit worktime used for their production. An increase in productivity depends upon changes in the work process which shortens the worktime essential to produce one unit of the goods. When productivity increases, "a lesser amount of work becomes capable of producing a greater quantity of usable values" (Marx).

In the broadest sense of the word a growth in productivity depends on the decrease of the total labor represented in the given product, hence equally the carried-over labor represented in raw materials and supplies from which the given product is manufactured as well as in machinery and

equipment by means of which the given product is produced and by the live labor spent directly in the production of the given article. "The growth of productivity essentially depends upon the fact," wrote Marx, "that the live labor part decreases and the carried-over labor part increases, but in such a way that the total labor represented by the article decreases, hence in a manner in which live labor decreases to a greater extent than the carried-over labor increases... For that reason the decrease in the amount of labor represented in the article, it would seem, should serve as the essential trait characterizing the raising of the productive force of labor, independently of the social conditions under which production takes place. In a society where producers regulate their production according to previously laid plans, even regarding the production of usual goods, productivity would unconditionally be measured by this criterion" (Marx, K., Kapital (Russian edition), 1949, Vol 3, pages 271-272).

The present state of the system of records of the national economy offers no possibility of directly measuring in time units the total labor represented in production. We have at our disposal only data defining in units of worktime (that is, man-hours, man-days, man-months) only the expenditure of live labor. The amount of labor previously performed and carried over into the product in the form of raw materials, materials, use of machinery, etc can be expressed from the records only in terms of value which, as is known, reflects the amount of represented labor in an approximate and inaccurate way. Only in the second phase of communist society will it be possible to measure the quantity of labor represented in a product, not in a roundabout way, not by means of value and its various forms as it is done now under conditions of commodity production, but simply and directly, by the quantity of time, the number of hours expended in the creation of products (Stalin).

In this connection, until such time as there is developed a system of production records in units of worktime, statistics of productivity studies only changes in expenditure of live labor for the production of certain articles. The productivity level is defined, therefore, as the ratio of the quantity of production to the quantity of live labor expended in its creation. The phenomenon of savings in expenditure of carried-over labor is the subject of statistical studies of material-technical supplies and the statistics of operating costs.

Statistics of productivity first of all studies the average level of productivity, which is obtained by dividing the amount of accomplished production by the total quantity of live labor used up in its production. Differences in the quality of this labor are not taken into account. In computing the amount of worktime used by the workers in production, the total of worktime is taken as expressed in units of worktime without regard of the differences in occupations and categories of the various workers, hence without consideration for simple and complex labor.

This is done, because in the present way of recording system serving Poland's national economy there is no way to accurately transpose complex into simple labor. Existing scales of wages concern various occupations and specialties, that is, work of different qualities which do not lend themselves to addition. Furthermore within the scope of one pay scale the qualification coefficients reflect not only the relationship of complex work of one category to simple work of the first category, but also policies of the state regarding wages, and for this reason they cannot be used as precise computation coefficients in the addition of simple and complex labor.

An essential factor in the full development of social productivity and its rapid tempo of growth is the compatability of production relations with the character of the creative forces. In the capitalist system, torn by internal conflict between the social character of production and the private, capitalist, form of ownership, the tempo of growth of social productivity must be considerably lower than the tempo in the socialist system.

In the report speech of the CC CP USSR [Central Committee of the Communist Party USSR] given at the Nineteenth Party Congress, G. M. Malenkov pointed to the following.

"In the period between 1940 and 1951, the productivity in industry rose by 50%, and the growth in industrial production for that period amounted to 70% as a result of the increase in productivity.

"...The rapid growth of productivity in the USSR is first of all the result of the broad application of new techniques and modern technological processes in the national economy, the result of mechanization and electrification of production, especially of the mechanization of labor consuming and heavy operations, as well as the result of better organization of work, the generally raised level of education and culture of the working masses, and the improvement of their production qualifications. The socialist economic system opens an unlimited field for the application of the most modern techniques. In the USSR machines not only save labor but also make the workers' labor easier and, as a result, workers in the socialist system, as opposed to those in capitalist system, use machines willingly. The soviet worker is directly interested in the increase of productivity, since he knows that it increases the economic might of the Soviet Union and raises the standard of living of the working masses. The unity of interests of state and nation forms the foundation

for the high productivity of social work under conditions of socialism" (Nowe Drogi, Special Number 1952, pages 36-37).

The task of statistics of productivity lies first of all in statistical control of the productivity quota fulfillment, and especially in bringing to light the hidden reserves of increased productivity and in the analysis of the influence of various factors on it.

In view of the fact that the amount of accumulation and therefore the total reproduction process on a broad scale depends upon the degree in which the dynamics of productivity is ahead of the dynamics of wages, one of the main tasks of statistics of productivity is the observation of these phenomena and their statistical characterization by means of properly constructed indices of the dynamics of productivity.

2. Computing the Level of Productivity

The size or level of productivity is measured by the size of production accomplished in a unit of time. If, for example, a laborer in 8 hours produces 24 shirts, then his productivity amounts to $24 \div 8 =$ 3 shirts per one hour. Productivity W, therefore, is computed according to the formula

$$W = \frac{Q}{T}$$

where Q is the amount of production accomplished in a given period of time, and T is the amount of time of that period used for the production of Q.

It is clear, that the higher the numerator of this fraction, that is, the greater Q, the greater will be W. Indeed the level of productivity rises in direct proportion with the increase of production per unit time. The more a worker produces per minute, hour, or any other unit of time, the higher is his productivity.

It is also easy to confirm that the larger the denominator T, the smaller will be W. That means that the level of productivity is inversely proportional to the amount of time used up in one unit of production. The more time it takes a worker to finish a unit of production, the lower is his productivity, and, inversely, the less time it takes him to complete a unit of production, the higher is his productivity. We designate by t the number of time units per unit of production. This quantity is computed in such a manner that the quantity of time used up in production is divided by the amount of accomplished production:

$$t = \frac{T}{Q} .$$

The quantity of time required to produce one unit of production, t, is known as the time consumption of the given product. If, for example, a worker produces during 60 minutes 6 m of cloth, then the time consumption of one m of cloth $t = 60 \div 6 = 10$ minutes. During one unit of time t, or during one minute, the worker produces $\frac{1}{t}$ or 1/10 m. In view of the fact that productivity is measured by the amount of production per unit of time, we can write that $W = \frac{1}{t}$. This agrees with the statement that productivity is inversely proportional to the time consumed in the production of one unit, or its time consumption.

In order to compute correctly the level of productivity, one should be able to obtain precise measurements of both production and worktime.

A. Production

As is known, the amount of production can be expressed quantitatively in physical or in arbitrary units of measure, specifically in man-hours normed either in workhours or by value in monetary units.

a. Quantity of Production. The computation of the level of production does not present any difficulties in a case where the amount of accomplished production taken quantitatively is expressed in physical units of measure, as for example in m, kg, l, pieces, etc. If, for example, 100 workers in a clothing factory sewed 10,000 shirts in January and 11,000 in February, we can easily establish that the average productivity of 1 worker in January was $\frac{10,000}{10} = 100$, and in February $\frac{11,000}{100} = 110$ shirts, which means that the productivity in February rose by 10% ($\frac{110}{100} = 1.1 = 110\%$).

The comparison of the productivity level of several enterprises of a similar nature or of one enterprise during several periods of time is possible only when absolute comparability of the quantity of production is maintained. It is possible to compare productivity in the mine "Wesola 1" with the productivity in the mine "Zabrze," since in both mines the productivity is measured by the quantity of mined coal expressed in t. There is however no sense in comparing the productivity of miners with the productivity of a cloth factory, where the amount of produced cloth is expressed in running m.

The problem of maintaining absolute comparability should be treated in the broadest sense of the word. We deal here with a situation where "the productive power of labor is described by a variety of circumstances, among others the average level of the worker's skill, the degree of development of science and its technological applications, the social organization of the productive process, the extent and effectiveness of the means of production, as well as natural conditions" (Marx, K., Kapital, Vol I, Ksiazka i wiedza 1951, page 42).

On the whole, the greatest comparability exists in the mining industries, the so-called "raw materialless" ones, where the technological

process of production is essentially the same. Even in these branches of industry, however, natural conditions may have a decisive effect on productivity. We know for example that the productivity of a coal miner working the opencast method is entirely different from the one working a regular mine. "The same amount of labor," wrote Marx, "supplies more ore in a rich mine than in a poor one, etc" (Ibid., page 42). Hence the conclusion that in comparing productivity measured in quantity of production expressed in physical units one must always keep in mind the natural conditions of production.

Changes in the organization of the productive process have a basic effect on comparability in the manufacturing industries. Let us assume, for example, that a textile factory employing 400 workers in the weaving department and 100 in the spinning department produced in January 500,000 m of cloth from yarn spun on the premises. The productivity of one worker, therefore, amounts to in January to $500{,}000 \div 500 = 1{,}000$ m. In February, though, as a result of the closing of the spinning department, the factory purchased ready yarn and again produced 500,000 m of cloth with the same number of employees, that is, 400, in the weaving department. The productivity per worker in February amounts to $500{,}000 : 400 = 1{,}250$ m. Presumably then the productivity in February rose by 25% ($\frac{1{,}250}{1{,}000} = 1.25 = 125\%$) by comparison with January. In reality, though, this apparent rise in productivity occurred only as a result of moving the process of production by one stage.

The application of the method of computing the productivity level by the amount of production expressed in physical units is possible only with relation to finished production. Unfinished production as a rule does not lend itself to expression in the same unit of measure as

finished production, which in turn makes it impossible to summarize the total production accomplished during the period under study. If, for example, a furniture factory produced in January 1,000 tables and in February 1,200, there exists a possibility of comparing the productivity in a quantitative sense. An entirely different situation exists, however, if during January the factory produced, over and above the 1,000 tables, 200 frames, 150 tops, and 300 sets of table legs, and in February, over and above the 1,200 tables, an additional 150 frames, 220 tops, and 280 sets of table legs. It is quite clear that it is not possible to add frames, tops and legs, since they are semiproducts of varying kinds, and in view of this it is not possible to obtain any comparability between the production in January and in February. It is therefore necessary to state that the computation of the level of productivity by the quantity of production is applicable in only those industries in which production is uniform and in which the unfinished production is insignificant or in which the unfinished production inventory at the end of the various report periods shows little or no variation. When statistical studies limit themselves to the finished products only, one should always note the unfinished production inventory in the beginning and at the end of the report period, since large changes in this inventory have a significant influence on the level of productivity. This can be clarified by means of the following example.

Let us assume that an inventory of unfinished production in a furniture factory as of 1 June listed 300 frames, 300 sets of table legs, and 300 tops, and as of 1 July only 100 frames, 100 sets of legs, and 100 tops. If the same number of employees produced during June and July 1,000 tables each, then there is no doubt that the productivity during June was lower than in July since the unfinished production inventory as of 1 June which entered into the July production was 200% higher than the unfinished production inventory as of 1 July.

In computing productivity according to quantity, it is essential to select the proper physical measurement unit, meaning a unit that will reflect the time consumption of labor of the article.

In some branches of industry this presents no problem. Let us take, for example, the production of bricks measured in pieces or the mining of coal measured in t. There is no doubt that a worker who produced 1,000 bricks works at double the productivity of a worker who produced only 500 bricks during the same amount of time. Similarly the productivity of a miner who dug 450 t of coal during a month is 50% higher than the productivity of a miner who got out only 300 t in the same period. An increased quantity of production however does not always indicate the same growth in productivity. Let us take, for example, the production of casts measured in t. Let us assume that the average productivity of one worker in the foundry amounted to in January to 10 t of casts and in February to 8 t. On the basis of these data one should not jump to the conclusion that the productivity of the worker was at a lower level in February than in January. One should also take into consideration the number of cast pieces were produced in January and in February. If the worker produced in January 10 cast pieces weighing one t each to the combined weight of 10 t, and in February 80 cast pieces of 100 kg each to the combined weight of 8 t, it is impossible to say that his productivity in February was lower than that in January. The point is that in this case the selected unit of measure for the casts, the t, has no direct association with the productivity, since the time-consumption of the casts lies not in their weight, but in their quantity, expressed in pieces.

A similar situation exists in cases where the quantity of production is measured by means of so-called arbitrary units. As is known, various soaps with a varying degree of fat content are computed as soap converted into the same content of fat, or alcohol of varying strength is computed as 100° strength. Let us assume then that the productivity of a worker in a still amounted in January to 1,000 l of 50° alcohol, which amounts to 500 l of 100° strength by computation in quantity and that the same worker produced in February only 500 l of 100° alcohol. At first glance his productivity during January and February remained at the same level, but even the layman realizes that the production of 1,000 l of 50° alcohol consumes more labor than the production of 500 l of 100° alcohol. Let us take as another example the work of a binder sewing notebooks. Notebooks of 16 pages can be computed on the basis of their utility value into 32-page notebooks at a rate of 1:2, or by multiplying the total number of 16-page produced notebooks by the computation coefficient of 0.5. If this worker then sewed 1,000 16-page notebooks on Monday (which by computation are equivalent to 1,000x0.5 = 500 32-page notebooks) and on Tuesday 1,000 32-page notebooks, then at first glance his productivity increased 100%, which quite clearly is not the case, since the sewing of a 32-page notebook does not require twice the amount of work needed for the sewing of a 16-page notebook. In statistical reporting practice, productivity on the basis of the quantity of production is computed only in those enterprises in the plans of which the productivity index is computed according to the quantity of one-unit production. It concerns the not too wide area of products which have a basic significance to the national economy.

b. Value of Production. The scope of applying productivity level computations according to the value of production is much wider. The productivity level according to value is computed according to the formula

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$$W = \frac{qp}{T},$$

where q is the number of produced articles,

p the unit cost of the article, and

T the amount of put in worktime.

For example, let us assume that a furniture factory employing 40 workers produced during a month the following articles.

Name of Product	Price per Unit in zlotys	Quantity of Production in pieces	Value of Production in zlotys
1	2	3	4
Wardrobes	2,000	10	20,000
Couches	1,300	15	19,500
Chairs	50	100	5,000
Deska	900	20	18,000
Total			62,500

The productivity per worker is: 62,500÷40 = 1,362.50 zlotys.

Computing the amount of accomplished production in the money sense, that is, by value of zlotys, one gains the advantage of being able to add various kinds of products and a comparability of productive level for various periods of time. Furthermore, by computing productivity according to value, one can also acoount for unfinished production.

Still, computing the productivity level according to the value of production does not permit the comparison of the productivity level for various kinds of industry or for enterprises producing different articles. Such comparison is devoid of any economic significance. If, for example, the value of production per one man-day in the coal industry amounts to 1,000 zlotys and in the perfume or jewelry industry to 10,000 zlotys, it does not follow that the productivity of a worker in the

perfume or jewelry industry is 10 times higher than that of a coal miner.

On this subject Marx wrote: "It is nonsense to speak of a higher or lower productivity in 2 varying branches of industry which describe the degree of productivity by means of a simple comparison of the value of their products" (Marx, K., Teori wartosci dodatkowej [Theory of Surplus Value], Russian edition, Vol II, Part I, 1936, Moscow, pages 187-188).

The selection of the method for the computation of the value of production is of extreme importance.

c. Gross Turnover. The computation of the value of production by the gross turnover method cannot be used for the purpose of computing productivity. As is known, in computing the gross turnover, the value of production accomplished in the various departments of the enterprise is added, that is, the same production may be added several times. Let us take as an example a textile enterprise composed of the following departments: spinning, weaving, finishing, and tailoring. Let us say that the value of produced yarn is 100,000 zlotys, that of the produced cloth 160,000, the value of finished materials 200,000, and the value of produced clothing, or the final product of this enterprise, 250,000 zlotys. The gross turnover of this enterprise equals: 100,000+160,000+200,000+250,000 = 710,000 zlotys. Thus, the value of produced yarn, for example is included 4 times, once as the value of production in the spinning department and 3 times as carried-over value in the production value of the weaving, finishing, and tailoring departments. Similarly, the production value of the weaving department is included 3 times, etc.

In order to compute the level of productivity, it is necessary to divide the amount of production by the time consumed in its production, which, with the application of the gross turnover method will not give a correct picture of productivity. The reason is that the worktime consumed is computed only once (as the sum of the amount of time put in by the workers of the spinning, weaving, finishing, and sewing departments), whereas the amount of production computed by the gross turnover method includes elements which are added several times. This is an additional reason why the method of gross turnover is not suitable for computing the productivity level.

d. Commodity Production. Neither can one use, in computing the productivity level, production computations done by the commodity production method. Here again the 2 factors entering into the computation of the productivity level, namely the amount of production and the amount of labor expended for its production, are not in direct relation to one another. Commodity production, in the statistical and not established economic sense of the word, comprises the production of finished products earmarked for the market, but does not include the unfinished production, whereas labor figures on production time include also the time consumed in the production of the unfinished articles. On the other hand commodity production includes those finished products which were partially produced (as unfurnished production) in prior study periods, but labor figures do not include the work consumed in periods prior to the period under study by the unfinished production.

The unsuitability of the commodity production method is extremely clear in industrial enterprises of a so-called long production cycle, as for example, in the shipyard industry. In view of the fact that the construction of a transocean liner takes a year or 2, the shipyard can not express its accomplishment in terms of commodity production. It

shows its quota fulfillment rather by means of gross production computed as the difference between the final and initial inventories of unfinished production for the report period. Were we to base our computation of productivity for the shipyard on commodity production, we would have to show the productivity from the beginning to the very end of the ship construction as zero, which is of course not the case.

It can be generally stated that commodity production is not suitable to the computation of the productivity level, because it does not include the total production created by the enterprise during the period under study for which labor figures of that period pertain.

e. Net Production. From a theoretical standpoint, production computation by the so-called net production method seems at first glance to be most justified. The production and labor in this method show the most direct relation One should however take into account the previously noted fact that data concerning the production for a given period refer only to the newly created value, or to the net production, and not to the value of the whole product which has in addition also a carried-over value. It is especially unsuitable, since a change in the part played by the carried over value, derived let us say from a shift of the starting point of the production process, etc, has a tremendous influence on the level of productivity.

In emphasizing the theoretical advantages of defining the level of production on the basis of production computed by the net production method, it is necessary to note at the same time that this method has no practical significance. First of all, net production is not computed at the enterprise level, and it is only computed for yearly periods at higher organization levels of the national economy. The practical need for productivity data is at the level of the enterprise or even at the

department level and for short periods of time, such as for the month or even for the week. Secondly, computation of net production at fixed prices encounters technical difficulties in view of the lack of established fixed prices for many of the factors which enter into the concept of the carried-over value --"c."

f. Gross Production. The only method of production computation used for the computation of the level of productivity is the gross production method.

In computing the level of productivity on the basis of the gross value of production there also lacks the direct connection between the production and the worktime consumed in it, since the worktime (T) expresses only the amount of work expended in the creation of the new value of production (v+m), whereas the value of production (q) comprises the carried-over, represented work as well as the newly created value (c+v+m).

Certain distortions of the picture of the productivity level are also caused by the fact that, in accordance with prescribed regulations, the gross value of production includes the value of typical semiproducts to be further processed in a given enterprise. As a result of this procedure, some elements of the production are included in the production twice, whereas the amount of labor consumed in their production is figured only once.

In those enterprises whose plans include unfinished production the value of gross production also includes the value of the unfinished production inventory differential. This circumstance also influences the level of productivity and in some cases increases the gap between the value of production and the quantity of the time consumed for it.

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The problem here is the fact that unfinished production includes the value of all production-in-process regardless of the stage of its advancement in the production process. For example, a bale of silk may be issued from the storeroom to the sewing department, the value of the bale being 100,000 zlotys, and during the period under study only one operation may be carried out on this bale, increasing its value by 500 zlotys or to a total value of unfinished production of 100,500 zlotys. This causes a distortion of the productivity level picture, since the apparent increase in level is due, not to the increased productivity, but to the increase in the part of the carried-over value of the total production value. One should keep in mind the fact that in unchanged conditions of the production process from the standpoint of the technical staffing of the factory and the kind of used raw materials and materials, the part played by the carried-over value (c) in the total value of gross production does not undergo significant change. The situation is entirely different in the case of unfinished production, since the part played by it depends upon the stage of advancement of the productive process of unfinished production in the beginning and at the end of the period under study.

In computing the productivity level for a whole industry, it should be borne in mind that the value of gross production in industry is computed by the factory method.

In computing gross production by the factory method, the magnitude of production increases with the degree of breaking up of large enterprises into small, and inversely, decreases with the consolidation of small enterprises into large. Organization changes do not have any effect however on the number of workers or the amount of work which they put in production. Hence, as a final result, changes in the organizational

structure of the industry affect the absolute magnitude of productivity computed for the whole industry by the "plant" method in the computation of the value of gross production.

It is clear that these apparent changes in the value of production do not reflect changes in the amount of produced articles.

g. Production Expressed in Norm Man-Hours. In practice there occur cases when the productivity level cannot be computed either on the basis of the quantity or of the value of production. This happens when an enterprise produces, for example, varying parts of products which are not subject to quantity addition or which lack prices both fixed and current, by means of which the value of production could be computed. In such cases the level of productivity is computed on the basis of the magnitude of production expressed in norm man-hours. This method is based on the fact, that the accomplished production is expressed in units of time essential for its production according to the established norms for it. The productivity level is computed according to the equation

$$W = \frac{q_1 t_n}{T_1} = \frac{q_1 t_n}{q_1 t_1},$$

where q_1 is the number of articles actually produced,

t_n is the quantity of work needed to produce a unit of the product according to the norm,

t_1 is the time actually consumed in the production of a unit, and

T_1 is the total time actually worked.

In other words, the amount of time necessary for production according to norm is divided by the actual time worked.

Example:

Name of Product	Norm Time per unit in man-hours t_n	Quantity of production in pieces q_1	Total Time according to norm $q_1 t_n$	Actual Time Worked in man-hours
A	4	100	400	350
B	5	150	750	600
C	2	80	160	180
D	6	20	120	110
Total		x	1,430	1,240

The level of average productivity computed on the amount of production expressed in norm man-hours then equals

$$\frac{1,430}{1,240} = 1.1532.$$

This means that in one unit of time 1.1532 units of production were produced as expressed in norm man-hours.

The scope of applying this method is limited only to products and activities having established norms.

The advantage of this method lies in the fact that the magnitude of production expressed in norm man-hours describes only the newly created part of accomplished production, and the carried-over labor represented in the product, and the level of productivity is not distorted by the part played by carried over labor in the total magnitude of production.

There are no reservations in the use of this method in computing the level of productivity for one product. However, in computing a collective index of productivity for several articles, the varying

degree of "rigidity" of the norm may cause some distortion of the productivity level picture during changes in the variety structure of the products, which we will discuss in detail in the next subchapter.

h. Production Expressed in Work-hours. The method of computing the size of production in workhours is much more widely applied in the computation of the productivity level. This method depends upon the fact that articles produced during a certain "comparative" period are expressed in units of worktime actually used in the production of articles during that period. The production done in the period under study is in turn expressed in workhours, multiplying the number of the various articles by the worktime used in the production of one unit of that article in the comparative period.

The productivity level is computed according to the equation

$$W = \frac{q_1 t_{no}}{T_1},$$

where q_1 is the amount of production during period under study,

T_1 is the time put in during period under study, and

t_{no} is the average time consumption per unit article during comparative period.

Thanks to the application of this method, it is also possible to express in workhours that part of the production which is not covered by norms. This method obviously cannot be applied to new products which were not produced during the comparative period.

One should further distinguish between a workhour, which is a measure of the amount of production, and man-hour, which is a unit of measure of the time put in by the worker.

The manner of computing the level of productivity on the basis of production expressed in workhours is given below.

It is easy to see that the equation given above for the computation of the productivity level on the basis of production expressed in workhours does not differ from the equation for the computation of the index of dynamics of productivity based on time consumption.

B. Worktime

The level of productivity expresses the average amount of production per unit worktime used for its production. As is known, units of the measure of time are man-hours, man-days, man-months, etc, and the level of productivity is computed in such a manner that the total amount of accomplished production is divided into the total man-hours or days or months consumed in the production.

Depending upon the selection of the unit of time different pictures of the dynamics of productivity is obtained, since the level of productivity changes not only with the change of productivity but also with the change of the degree of worktime utilization. Let us assume, for example, that an enterprise employing 100 workers produced in January articles of a joint value of 1,725,000 zlotys, and in February, maintaining the same employment, 1,824,000 zlotys. The average length of the working day in January was 7.5 hours and in February 7.6 hours. The average length of the working month in January was 23 days and in February 20 days. On the basis of these data we can compute the level of productivity, accepting in the computations various worktime units.

1. Average productivity per worker per worked man-month:

in January 1,725,000÷100 = 17,250

in February 1,824,000÷100 = 18,240

Index $\frac{18,240}{17,250} \times 100 = 105.74\%$

2. Average daily productivity, or per one man-day worked:

In January 1,725,000÷2,300 = 750

In February 1,824,000÷2,000 = 912

Index $\frac{912}{750} \times 100 = 121.6\%$

3. Average hourly productivity, or for one man-hour worked:

In January 1,725,000÷17,250 = 100

In February 1,824,000÷15,200 = 120

Index $\frac{120}{100} \times 100 = 120\%$

The total number of worked man-hours in January, 17,250, was computed as the product of the average length of workday, the number of workdays during the month, and the average number of workers (7.5x23x100 = 17,250). The total of worked man-hours in February was similarly computed.

In the above example the index of the dynamics of the daily productivity is higher than that of the hourly productivity (120 and 121.6). This is quite understandable, since the increase in the level of productivity was affected by the increased productivity as well as the better utilization of the workday during February by comparison with January (7.6 and 7.5). On the other hand the index of productivity per worker shows a lower dynamics rating (105.74), which was undoubtedly caused by the poor utilization of the workmonth (23 and 20 days). We see therefore that the picture of the dynamics of productivity depends on, among other things, the selection of the unit of time by which worktime was measured.

It is easy to note that the presentation of the indices of the dynamics of the hourly, daily, and monthly productivity characterizes also the degree of worktime utilization. With an unchanged degree of utilization of the daily and monthly worktime during the periods under study, the index for the dynamics of the daily or monthly productivity will not vary from that of hourly productivity. However, in a varying degree of utilization of the workday or workmonth during the periods under study, deviations of the indices of the dynamics of productivity for the daily and monthly periods from those of the hourly productivity must occur, which can easily be explained.

It should be emphasized that the comparison of the dynamics index for the day or month against the hourly dynamics index of productivity shows the degree of worktime utilization more clearly than the index of the dynamics of daily and monthly wages as compared with the hourly index and which will be discussed later. This is explained by the fact that the various components of worktime performed or omitted is paid by various rates (for example, overtime, unpaid vacations, etc) as a result of which the dynamics of the various payrolls (daily, monthly) are affected not only by changes in the degree of worktime utilization but also by variations in the wage rates of the various worktime components.

From the standpoint of the national economy as a whole, of the greatest importance are the indices of average monthly or yearly productivity, in view of their comprehensive nature.

These indices show the level of productivity as a result of both productivity and degree of worktime utilization on which the real size of social production depends. On the other hand, hourly or daily productivity indices are distinctly analytical in nature and find their application primarily in the statistical studies conducted within the scope of the enterprise itself.

The worktime consumed in production can be computed in relation to workers employed directly in the production process or in relation to the total workers listed in the laborers subgroup only in the industrial group of workers or in relation to all workers included in the industrial group.

The productivity index computed per worker of the industrial group is more comprehensive in nature than the index computed per worker of a narrower group of employees.

In current statistical reporting, productivity is computed per man-hour as well as per man-month.

3. Indices of the Dynamics of Productivity

In its simplest meaning the index of the dynamics of productivity is computed as the ratio of the productivity level during the period under study, W_1, to the productivity level of a basic period, W_o. Since

$$W_1 = \frac{Q1}{T_1}, \text{ and } W_o = \frac{Q_o}{T_o},$$

we can write the index of the dynamics of productivity as

$$i = \frac{W_1}{W_o} = \frac{Q_1}{T_1} \div \frac{Q_o}{T_o},$$

where Q_1 and Q_o are the amounts of production during the studied and basic periods, and T_1 and T_o are the corresponding worktimes put in during these periods.

The given equation, on rewriting, can take the form

$$i = \frac{Q_1}{T_1} \div \frac{Q_o}{T_o} = \frac{Q_1}{Q_o} \div \frac{T_1}{T_o}.$$

As is known, the index of dynamics of production is computed according to $\frac{Q1}{Qo}$, and the index of dynamics of employment (worktime) by means of $\frac{T_1}{T_o}$.

The index of the dynamics of productivity therefore expresses the ratio of the index of the dynamics of production to the index of the dynamics of employment. We can therefore compute the index of the dynamics of productivity by dividing the index of the dynamics of production by the index of the dynamics of employment or put-in worktime.

Further rewriting the equation for the index of the dynamics of productivity we obtain

$$i = \frac{Q_1}{Q_o} \div \frac{T_1}{T_o} = \frac{T_o}{Q_o} \div \frac{T_1}{Q_1} .$$

The expression $\frac{T_o}{Q_o} \div \frac{T_1}{Q_1}$ is the equation for the computation of the index of the dynamics of productivity based on time consumption, since it expresses the dynamics of the amount of time consumed per unit of the product and not the amount of production per unit of worktime. This formula can be presented in the form of $i = \frac{t_o}{t_1}$, where

$$t_o = \frac{T_o}{Q_o}, \text{ and } t_1 \frac{T_o}{Q_1} .$$

With the aid of the example given below we can easily be convinced that the use of each of the forms given below will bring the same result.

Itemization	January	February	Index in %
Production in 1,000 pieces	2,000	3,000	150
Worked man-hours	50	60	120
Productivity in pieces per one man-hour	40	50	125

And indeed, if we apply the equation $i = \frac{Q_1}{T_1} \div \frac{Q_o}{T_o}$ we obtain the index of the dynamics of productivity equals

$$\frac{3,000}{60} \div \frac{2,000}{50} = 50 \div 40 = 1.25 = 125\%.$$

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We shall get the same result applying the equation

$$i = \frac{Q_1}{Q_0} \div \frac{T_1}{T_0},$$

namely, $\frac{3,000}{2,000} \div \frac{60}{50} = 1.5 \div 1.2 = 1.25 = 125\%$,

as well as by applying the formula $i = \frac{T_0}{Q_0} \div \frac{T_1}{Q_1}$,

namely $\frac{50}{2,000} \div \frac{60}{3,000} = 0.025 \div 0.02 = 1.25 = 125\%$.

The index of the dynamics of productivity according to the amount of production of a one-kind article measured in physical units is computed according to the equation $i = \frac{Q_1}{T_1} \div \frac{Q_0}{T_0}$, and for several enterprises according to the equation $I = \frac{\sum q_1}{\sum T_1} \div \frac{q_0}{T_0}$.

This is the formula for the index of the dynamics of productivity of a changing nature.

The size of the index computed by the above equation is affected not only by the productivity but also by a change in structure, as is easily proven by the example given below.

Name of Enterprise	Production in pieces		No of Employees		Productivity		Productivity index in %
	January	February	January	February	January	February	
	q_0	q_1	T_0	T_1	W_0	W_1	$\frac{W_1}{W_0} \times 100$
A	2,000	3,600	40	60	50	60	120
B	1,200	1,000	60	40	20	25	125
Jointly	3,200	4,600	100	100	32	46	143.91

As is seen from the above example, the productivity in enterprise A rose 20%, in enterprise B 25%, and jointly in both enterprises 43.91%.

The markedly higher joint productivity rise for the 2 enterprises as compared to the rise for each one individually is explained by the change in structure of the phenomenon under study. This change consisted in the fact that the participation of enterprise B of a lower productivity level in the total production fell, whereas the part played by enterprise A of a higher productivity level rose during the period under study from 40% to 60%.

The index of the dynamics of the average productivity of a changing structure reflects truthfully the studied reality as in the increase of every percent of this index lies the real growth of the concrete quantity of useful values. This index is comprehensive in nature, since it shows the entirety of the changes occurring in the level of productivity regardless of the factors which caused it. For this reason too, the indices of the dynamics of average productivity in the national economic plans are computed as dynamics indices of a changing structure.

For analytical purposes, it is also possible to compute the index of the dynamics of the average productivity for a constant structure as the arithmetical mean of the individual indices of the various enterprises, weighted by the number of employees working in the various enterprises, during the period under study or the time put in by them during the period:

$$I = \frac{\Sigma\left(\frac{q_1}{T_1} : \frac{q_0}{T_0}\right) \cdot T_1}{\Sigma T_1}$$

In the example given above the value of this index will be:

$$\frac{\left[\left(\frac{3\,600}{60} : \frac{2\,000}{50}\right) \cdot 60\right] + \left[\left(\frac{1\,000}{40} : \frac{1\,200}{60}\right) \cdot 40\right]}{60 + 40} =$$

$$= \frac{[(60 : 50) \cdot 60] + [(25 : 20) \cdot 40]}{100} =$$

$$= \frac{(1{,}2 \cdot 60) + (1{,}25 \cdot 40)}{100} = \frac{122}{100} = 1{,}22 = 122\,\%$$

Marking the individual indices of the various enterprises by

$$i = \frac{q_1}{T_1} : \frac{q_0}{T_0} = \frac{W_1}{W_0}$$

we get a simpler form of the index of the dynamics of productivity of a constant structure:

$$I = \frac{\sum \frac{W_1}{W_0} \cdot T_1}{\Sigma T_1} = \frac{\Sigma_i T_1}{\Sigma T_1}$$

The dynamics index for productivity of a constant structure shows only the average change of the individual levels of production, whereas the dynamics index of productivity of a changing structure characterizes the changes of the average productivity level in the studied collective group as a whole.

Example: Name of factory	Quantity of production in m		No of Employees		Productivity		Productivity index in %
	Jan q_o	Feb q_1	Jan T_o	Feb T_1	Jan W_o	Feb W_1	$\frac{W_1}{W_o} \times 100$
Hand weaving mill	20,000	96,000	20	80	1,000	1,200	120
Mechanized weaving mill	800,000	220,000	80	20	10,000	11,000	110
Jointly	820,000	31[illegible],000	100	100	8,200	3,160	38.53

As is seen from the above example, the average productivity during February rose in the hand weaving mill by 20% and in the mechanized weaving mill by 10% as compared with January.

Accompanying this growth in productivity in each mill however was another phenomenon. Let us even assume that, due to an accident in the mechanized weaving mill, 60 employees of the mechanized mill transferred into the hand mill in February.

This phenomenon, in the final result, accounted for the entire enterprise comprising both mills, the average productivity fell by 100%-38.53% = 61.47%.

This state of affairs, essential from the standpoint of the national economy, is reflected correctly in the index for the dynamics of productivity of a changing structure which is computed according to

$$I = \frac{\Sigma q_1}{\Sigma T_1} : \frac{\Sigma q_0}{\Sigma T_0}$$

which in the given example amounts to

$$I = \frac{316\,000}{100} : \frac{820\,000}{100} = 0{,}3853 = 38{,}53\%$$ Istotnie, wsku-

Indeed, as a result of the decrease in the average productivity in the enterprise as a whole, this enterprise produced in February only 316,000 m as compared with 820,000 in January with the employment of the same number of 100 workers.

Were we in the above example to compute the index of the dynamics of productivity at constant structure according to

$$I = \frac{\Sigma_i T_1}{\Sigma T_1}$$

we would obtain a value of the index of

$$\frac{(1{,}2 \cdot 80) + (1.1 \cdot 20)}{80 + 20} = \frac{96 + 22}{100} = 1{,}18 = 118\%$$

which would mean that the average productivity in the enterprise rose by 18%. In actuality there is no real increase in the concrete quantity

of usable goods to correspond to this increase in average productivity in the individual factories.

In order to measure the influence of the change in structure on the dynamics of productivity in the enterprise, it is necessary to divide the index for the dynamics of productivity at changing structure by the one at constant structure.

In the given example this influence amounts to

$$0.3853 \div 1.18 = 0.3266 = 32.66\%.$$

This means that as a result of the change in structure, the average productivity in the enterprise fell by 100-32.66 = 67.34%, and this fall was only partially compensated for by the increase in the average productivity in the various enterprises resulting in a net of 61.47%.

By means of the formula for the index of the dynamics of productivity at changing structure, it is possible to compute the dynamics of production for production expressed in physical units of measure only for articles of one kind. In order to compute the dynamics of production for several kinds of articles, it is necessary to use the formula for the index at constant structure, which, as mentioned before, expresses only the average of the individual productivity indices computed for the various articles separately.

This index can also be computed according to the formula for the aggregate index based on time consumption namely

$$I = \frac{\sum q_1 t_o}{\sum q_1 t_1},$$

where t_o and t_1 indicate the time consumed in the production of one unit of the article, that is, the time consumption, for the basic and studied period.

The above form of the aggregate index can also be obtained by modifying the index of the dynamics of productivity at constant structure in such a way that the T which signifies the total put-in worktime is replaced by the product of q, the quantity of production, and t, its time consumption. We start out with the assumption that T = qt, that is, that the total put-in worktime equals the quantity of produced articles multiplied by their time consumption, that is, by the amount of time used for the production of one article. We thus obtain

$$I = \frac{\sum\left(\frac{q_1}{T_1} : \frac{q_0}{T_0}\right) T_1}{\Sigma T_1} = \frac{\sum\left(\frac{q_1\, T_0}{T_1\, q_0}\right) T_1}{\Sigma T_1} = \frac{\sum \frac{q_1\, T_0\, T_1}{T_1\, q_0}}{\Sigma T_1} =$$

$$= \frac{\sum q_1 \frac{T_0}{q_0}}{\Sigma T_1} = \frac{\sum q_1 \frac{q_0\, t_0}{q_0}}{\Sigma q_1\, t_1} = \frac{\Sigma q_1\, t_0}{\Sigma q_1\, t_1}$$

Applying for the example given above the formula for the index of the dynamics of constant structure, we obtain a productivity index for all products of:

$$\frac{4\,200\,000}{22\,900} \quad 183{,}4\,\%$$

Analoguous figures are obtained from the production of the dynamics of productivity according to the aggregate index of the dynamics of productivity based on time consumption:

$$\frac{42\,000}{22\,900} = 1{,}834 = 183{,}4\,\%$$

In cases where the amount of production is expressed in arbitrary units of measure, the index of the dynamics of productivity at changing structure is computed according to the formula

$$I = \frac{\Sigma\, q_1 k}{\Sigma\, T_1} : \frac{\Sigma\, q_0 k}{\Sigma\, T_0} = \frac{\Sigma\, q_1 k}{\Sigma\, q_0 k} : \frac{\Sigma\, T_1}{\Sigma\, T_0}$$

where k is the coefficient of conversion of the various products into the arbitrary units.

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Example:

Product	Unit of measure	Quantity of production January-February		Man-Hours Worked		Time Consumption		Productivity January-February		Productivity index in %	Weighted productivity indices	Arbitrary quantities
				January	February	January	February					
		q_o	q_1	$T_o=q_o t_o$	$t_1=q_1 t_1$	$T_o:q_o t_o$	$T_1:q_1=t_1$	$q_o:T_o$	$q_1:T_1$	$\frac{q_1}{T_1}:\frac{q_o}{T_o}$	$(\frac{q_1}{T_1}:\frac{q_o}{T_o})T_1$	$q_1 t_o$
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
A	m	2,000	1,600	20,000	8,000	10	5	0.1	0.2	200	1,600,000	16,000
B	piece	3,000	4,000	6,000	5,000	2	1.25	0.5	0.8	160	800,000	8,000
C	kg	1,000	1,200	2,500	2,400	2.5	2	0.4	0.5	125	300,000	3,000
D	m^3	4,000	3,000	20,000	7,500	5	2.5	0.2	0.4	200	1,500,000	15,000
Total					22,900						4,200,000	42,000

Example:

Name of Product	Conversion coefficient K (arbitrary data)	Production in t		Put-in Time in man-hours	
		January q_o	February q_1	January T_o	February T_1
1. Laundry soap	0.3	10	11	1,000	1,000
2. Toilet soap	0.8	8	9	800	820
3. Technical soap	0.2	60	70	12,000	11,000
4. "Family" soap	0.4	2	3	200	280
5. Luxury toilet soap	1.0	4	4	300	240
Total				14,300	13,340

On the basis of the data in the above example, this index may be computed as follows:

$$I = \frac{(11 \cdot 0{,}3) + (9 \cdot 0{,}8) + (70 \cdot 0{,}2) + (3 \cdot 0{,}4) + (4 \cdot 1{,}0)}{13\,340} :$$

$$: \frac{(10 \cdot 0{,}3) + (8 \cdot 0{,}8) + (60 \cdot 0{,}2) + (2 \cdot 0{,}4) + (4 \cdot 1{,}0)}{14\,300} =$$

$$= \frac{29{,}7}{13\,340} : \frac{26{,}2}{14\,300} = \frac{29{,}7}{26{,}2} : \frac{13\,340}{14\,300} = 1{,}1374 : 0{,}9328 =$$

$$= 1{,}2193 = 121{,}93\,\%$$

We have already discussed above the fact that the main shortcoming of the method of computing the amount of production in arbitrary units lies in the fact that the conversion coefficients express most frequently the utilitarian value of the articles, but have not relation to their time consumption. For this reason this method has a limited scope of application.

A much better common denominator for articles of various kinds can be obtained by expressing the accomplished production in norm hours. On the basis of this method the index of the dynamics of productivity at changing structure is computed according to the equation

$$I = \frac{\Sigma q_1 t_n}{\Sigma T_1} : \frac{\Sigma q_0 t_n}{\Sigma T_0}$$

where t_n is the amount of time per unit product according to the norm.

Since $T_1 = q_1 t_1$, and $T_0 = q_0 t_0$, the given equation can be changed into the form

$$I = \frac{\Sigma q_1 t_n}{\Sigma T_1} : \frac{\Sigma q_0 t_n}{\Sigma T_0} = \frac{\Sigma q_1 t_n}{\Sigma q_1 t_1} : \frac{\Sigma q_0 t_n}{\Sigma q_0 t_0}$$

From the above it can be seen that the index for the dynamics of productivity of a changing structure, computed on the basis of production expressed in norm hours, actually expresses the ratio of 2 indices of norm fulfillment, namely the ratio of the index of norm fulfillment in the period under study to the index of norm fulfillment in the basic period.

The value of this index depends not only on the change in the degree of norm fulfillment established for the various articles, but also on the change in the extent to which the various articles form the total of the production, in other words on the change of structure of the studied aggregate. The point is that 'rigidity' of the norms established for the individual articles differs. Some norms are easily exceeded by a large percentage and some by a much smaller one. As the portion of the total production of articles of a more 'difficult' norm increases, the average general index of productivity of a changed structure falls below the average index of the dynamics of productivity. An increase in the portion of the total production of articles of a 'lighter' norm causes an increase in the index of the dynamics of productivity computed for the whole of the production greater than the increase of the indices of the dynamics of productivity computed for the individual articles.

In order to compute the effect of the change in structure upon the productivity level, it is necessary to divide the index of the dynamics of productivity of a changing structure by the index of pro-

ductivity of a constant structure or by the variety of products structure during the basic period, namely

$$\left(\frac{\Sigma q_1 t_n}{\Sigma q_1 t_1} : \frac{\Sigma q_0 t_n}{\Sigma q_0 t_o}\right) : \left(\frac{\Sigma q_0 t_n}{\Sigma q_0 t_1} : \frac{\Sigma q_0 t_n}{\Sigma q_0 t_o}\right) = \left(\frac{\Sigma q_1 t_n \cdot \Sigma q_0 t_o}{\Sigma q_1 t_1 \cdot \Sigma q_0 t_n}\right) :$$

$$: \left(\frac{\Sigma q_0 t_n \cdot \Sigma q_0 t_o}{\Sigma q_0 t_1 \cdot \Sigma q_0 t_n}\right) = \frac{\Sigma q_1 t_n \cdot \Sigma q_0 t_o \cdot \Sigma q_0 t_1 \cdot \Sigma q_0 t_n}{\Sigma q_1 t_1 \cdot \Sigma q_0 t_n \cdot \Sigma q_0 t_n \cdot \Sigma q_0 t_o} =$$

$$= \frac{\Sigma q_1 t_n}{\Sigma q_0 t_n} : \frac{\Sigma q_1 t_1}{\Sigma q_0 t_1}$$

Hence the index of the dynamics of productivity, being the result of only structural changes, expresses the ratio of 2 indices of the dynamics of production, of which the first is weighted by the time norm for a unit of the article and the second by the time consumption of the articles during the period under study.

The manner of computing the index of the dynamics of productivity on the basis of production expressed in norm hours is represented in the following example.

Example:

Name of Product	Time norm per unit of product in man-hours	Completed Production in pieces		Completed Production in norm hours		Time Worked in man hours		Work Consumption		Productivity index based on work consumption in %	Norm quota fulfillment index		Arbitrary magnitude
		January	February	January	February	January	February	January	February		January	February	
	t_n	q_o	q_1	$q_o t_n$	$q_1 t_n$	$T_o = q_o t_o$	$T_1 = q_1 t_1$	$t_o = \frac{T_o}{q_o}$	$t_1 = \frac{T_1}{q_1}$	$\frac{t_o}{t_1} \times 100$	$\frac{q_o t_n}{q_o t_o}$	$\frac{q_1 t_n}{q_1 t_n}$	$q_o t_1$
1	2	3	4	5	6	7	8	9	10	11	12	13	14
A	4	100	140	400	560	330	420	3.3	3	110	121.21	133.33	300
B	6	50	150	300	900	275	750	5.5	5.	110	109.09	120.0	250
C	5	80	100	400	500	352	400	4.4	4	110	113.63	125.00	320
	Total			1,100	1,960	957	1,570				114.94	124.84	870

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In this example the index of the dynamics of productivity of changing structure equals

$$124{,}84 : 114{,}94 = 108{,}61\%$$

This index is lower than the individual indices computed on the basis of the time consumption which amounts to 110% for each of the products (column 11), which is a result of the changes in the structure of the variety of production. The portion of the total of production expressed in norm hours of product 'B' (columns 5 and 6), whose norm fulfillment index for the basic period is the lowest amounting to barely 109.09 (column 12), rose considerably during the period under study, namely from 27.27% to 45.91%, from $(\frac{300}{1{,}100} \times 100)$ to $(\frac{900}{1{,}960} \times 100)$, which in turn caused the lowering of the productivity index of changing structure for all products taken together. The value of the index of the dynamics of productivity which result only from structural changes according to the formula

$$\frac{\Sigma q_1 t_n}{\Sigma q_0 t_n} : \frac{\Sigma q_1 t_1}{\Sigma q_0 t_1}$$

$$\frac{1\,960}{1\,100} : \frac{1\,570}{870} = 1{,}7818 : 1{,}8046 = 0{,}9873 = 98{,}73\%$$

Hence structural changes caused the lowering of the index of the dynamics of productivity by 100-98.73 = 1.27%.

The index of the dynamics of productivity at constant structure amounts to 1.0961÷0.9873 = 1.1 = 110%.

The index of the dynamics of productivity at constant structure equals the average of the individual indices of productivity computed on the basis of the time consumption of the individual articles (Column 11) or

$$\frac{(110 \cdot 420) + (110 \cdot 750) + (110 \cdot 400)}{1\,570} = 110\%$$

We mentioned before that the method of computing the amount of production in norm hours is limited to articles and operations which have established norms. Wishing then to compute the dynamics of productivity also for those articles and operations which do not have established norms, it is necessary to apply the index of the dynamics of productivity of changing structure computed on the basis of production expressed in workhours. This index is computed according to the formula

$$I = \frac{\Sigma q_1 t_{no}}{\Sigma T_1} : \frac{\Sigma q_o t_{no}}{\Sigma T_o}$$

and in view of the fact that $T = qt$, we can substitute and obtain this form:

$$I = \frac{\Sigma q_1 t_{no}}{\Sigma q_1 t_1} : \frac{\Sigma q_o t_{no}}{\Sigma q_o t_o}$$

where q_1 is the quantity of articles produced in studied period,

q_o is the quantity of articles produced in basic period,

t_{no} is the average time required per unit article in the "comparison" period,

t_1 is the average time required per unit article in studied period, and

t_o is the average time required per unit article in basic period.

It should be emphasized that the method for computing the index of the dynamics of productivity on the basis of production expressed in workhours does not differ basically from the one computed on the basis of norm hours. The only difference lies in that in the computation by workhours, instead of an established time norm, the actual average time of production of a given article during the "comparison" period is used. And according to this figure both production of the 'comparison' and the studied period are computed.

The following example illustrates the computation of the index on the basis of workhours.

The method of computing the dynamic index of labor productivity based on production expressed in workhours is illustrated by the example on page 240.

In this example the month of January was taken as the comparative period.

The average time used for the produced unit in the comparison, t_{no}, was computed by dividing the worktime in January, T, by the amount of production, q. In this manner t_{no} for the produced unit "A" equals $50 \div 50 = 1$, for the produced unit "B" $660 \div 200 = 3.3$, and for "C" $450 \div 100$ 4.5.

It has already been mentioned that in the current statistical report the level of labor production is computed on the basis of overall production expressed in monetary units and that only in some commercial enterprises labor productivity is computed on the basis of production expressed in physical measurement units.

The dynamic index of labor productivity as based on the value of overall production in monetary units is computed according to the formula

$$I = \frac{\Sigma q_1 p_o}{\Sigma T_1} : \frac{\Sigma q_o p_o}{\Sigma T_o}.$$

where p_o is the comparative (fixed) price of the produced unit, and q_1 and q_o are the amounts of certain articles produced in the investigated and basic period.

In computing the index on the basis of cost production expressed in fixed prices, the effect of price fluctuation on the value of production and on the size of the index is eliminated.

Example (See Romanov, M. P., Statistika makomolno-krupianoj promyszlennosti, 1949, Moscow page 251):

Name of Product	January	February	March	April
	I. Amount of Production in Pieces, q			
A	50	100	100	150
B	200	200	200	200
C	100	300	400	400
	II. Total Time Worked in Man-hours, T			
A	50	75	80	100
B	660	600	500	400
C	450	1,200	1,500	2,500
Total	1,160	1,875	2,080	3,000
	III. Amount of Production in Workhours, $q\ t_{no}$			
A	50	100	100	150
B	660	660	660	660
C	450	1,350	1,800	1,800
Total	1,160	2,110	2,560	2,610
	IV. Average Hourly Productivity in Workhours, $qt_{no} \div T$			
A	1.0	1.333	1.250	1.500
B	1.0	1.100	1.320	1.650
C	1.0	1.125	1.200	0.720
General Average	1.0	1.1253	1.2507	0.8700
	V. Index of the Dynamics of Productivity in %, $\frac{q_1 t_{no}}{T_1} \div \frac{q_o t_{no}}{T_o}$			
A	100.0	133.0	125.0	150.0
B	100.0	110.0	132.0	165.0
C	100.0	112.5	120.0	72.0
General	100.0	112.53	123.07	87.0

In computing the individual index for a particular article, it does not matter which period's price is adopted as the fixed price, since the selection of the period has no effect on the index. If a worker produced 10 pieces of article A in January and 11 pieces of the same article in February, the index will always be 1.1 or 110% regardless of whether the fixed price of article A is taken as 10, 20, 25, or 67 zlotys. In each of these cases: $\frac{11x10}{10x10} = \frac{11x20}{10x20} = \frac{11x25}{10x25} = \frac{11x67}{10x67} = 1.1 = 110\%$.

In this case the index of the dynamics of productivity need not be computed on the basis of production expressed in monetary units, since it can be computed directly on the basis of production expressed in physical units.

The situation is different however when an aggregate index is computed on the basis of the value of production expressed in monetary units at fixed prices.

As is known, the price of an article expresses approximately the average amount of work represented in the article as socially necessary for its production. The relationship of the prices of various articles therefore represents approximately the relationship of the amounts of labor represented in them. This relationship is not constant, since it is subject to changes during various periods as well as changes in the average social productivity resulting primarily from technological progress. If, for example, at one time artificial silk stockings were about half as expensive as silk stockings, during later years, with the development of the technical progress in the manufacture of synthetic yarns, the price of artificial slik stockings went down to about 1/10 of the price of natural silk stockings. The change in the relationship of these products from 1:2 to 1:10 occurred because the time consumption

of the natural silk and its fiber remained unchanged, whereas the productivity of workers employed in the artificial fiber industry increased considerably. "This same change of the productive force," wrpte Marx, "which increases the fruitfulness of labor, decreases therefore the value of this increased general mass, if the sum of the worktime essential for its production decreased, and vice versa" (Marx, K., Kapital, Vol I, 1951, Ksiazka i Wiedza, page 49).

In evaluating accomplished production at constant prices for some period we overlook completely changes in the relationship of prices, or, in other words, we compute the accomplished production during both studied and basic periods according to the average social level of productivity which existed during the time of the fixed prices. This circumstance undoubtedly affects the size of the index of the dynamics of production and consequently the size of the index of the dynamics of productivity.

The above statement is illustrated in the following example.

Example

Name of product	Completed production in pieces		Price per piece		Worked man-months		Value of completed production				Productivity per one worker in zlotys				Dynamics of production index in %		Dynamics production index in %	
							at 1945 prices		at 1949 prices		at 1945 prices		at 1945 prices					
	January 1952	February 1952	in 1945	in 1949	January 1952	February 1952	January 1952	February 1952	January 1952	February 1952	January 1952	February 1952	January 1952	February 1952	at 1945 prices Column 9÷8	at 1949 prices Column 11÷10	at 1945 prices Column 13÷12	at 1949 prices column 15÷14
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
A	100	120	10	10	50	50	1,000	1,200	1,000	1,200	20	24	20	24	120	120	120	120
B	100	200	5	1	50	50	500	1,000	100	200	10	20	2	4	200	200	200	200
Total					100	100	1,500	2,200	1,100	1,400	15	22	11	14	140.60	127.27	140.60	127.27

As is seen from the above example, the size of the individual indices of the dynamics of productivity computed separately for articles A and B, as well as the size of the individual indices of the dynamics of production of these articles, does not change with relation to the selected period of fixed prices. On the other hand, a considerable change is noted in the aggregate index of both the dynamics of productivity and production with the use of the fixed prices for the year 1945 or 1949. In the first case the aggregate index of dynamics amounts to 140.60 and in the second to only 127.27 for the same total of accomplished production. The decrease in the aggregate indexes of production and productivity was due in the second case to a change in the relationship of the prices of products A and B from 10:5 to 10:1.

This property of the aggregate index of the dynamics of productivity based on the value of production expressed in fixed prices must be borne in mind in evaluating the dynamics of productivity.

In view of the above remarks, it is easy to understand that the selection of fixed prices of a period much removed from the prices of the studied and basic period will cause a distortion in the size of the index for the dynamics of productivity.

No wonder therefore that in the Soviet Union, as a result of tremendous achievements in technical progress and in the level of average social productivity, the need arose to abandon the application of fixed prices from the 1926-1927 period and base computations on postwar fixed prices.

The application of fixed prices is not subject to doubt in computing chain indices for consecutive periods, when the prices of the basic period are adopted as the fixed prices. In such a case the differences

in the level of the average social productivity in the national economy scale are not large, and they will not cause a distortion in the size of the index.

The aggregate index of the dynamics of productivity of changing structure is figured from the equation

$$I = \frac{\Sigma q_1 p_0}{\Sigma T_1} : \frac{\Sigma q_0 p_0}{\Sigma T_0}$$

The value of this index is affected by changes in the structure of production. As is known, the part played in the total carried over value of production varies in various branches of industry and in various industrial factories.

The change in the percentage fraction of the production of various branches of industry in the total value of production affects the productivity level of the industry as a whole and hence the index of the dynamics of production in industry.

It is worth citing as an example the "starting out" project of the first Five-Year Plan in the USSR (Table 1/VI). (See Sawinskiy, D. W., Kurs promyshlennoi statistiki (Russian edition), 1949, Moscow, page 206)

TABLE 1/VI

Economic Group	Gross Production according to 1926-1927 prices in million rubles		No of Workers, in thousands		Productivity per worker in rubles		Index of the dynamics of productivity in %
	1927-28	1932-33	1927-28	1932-33	1927-28	1932-33	
A	4,393	12,027	1,036	1,463	4,240	8,221	193.3
B	6,516	13,606	1,067	1,177	6,106	11,555	190.2
Total for Industry	10,909	25,633	2,103	2,640	5,187	9,709	187.2

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As is seen from the above example, the index for the dynamics of productivity is lower for the whole industry than for the individual industrial groups A and B. It is easy to understand why. From the data in the Table it is apparent that the productivity in the money sense is much higher for the consumer goods group B than for the means of production group A, since in group B the portion of the carried over value (raw materials, materials, etc) is considerably higher that in group A. Since, however, in accordance with the project of the first Five-Year Plan, the tempo of growth of group A is considerably larger than the tempo of growth for group B, the index of the dynamics of production is lower than either of the individual group indices. In order to eliminate the influence of structure changes, it is necessary to compute the index of the dynamics of productivity based on production expressed in fixed prices and of constant structure according to the equation

$$I = \frac{\sum \left(\frac{\Sigma q_1 p_o}{T_1} : \frac{\Sigma q_o p_o}{T_o} \right) T_1}{\Sigma T_1}$$

In the cited example the value of the index of constant structure is:

$$\frac{(193{,}3 \cdot 1\,463) + (189{,}2 \cdot 1\,177) \cdot 100}{1463 + 1\,177} = 191{,}47\%$$

Rewriting the above equation, we can give it the form of the aggregate index of the corresponding arithmetic mean weighted against the dynamics index at constant structure:

$$I = \frac{\sum \left(\frac{\Sigma q_1 p_o}{T_1} : \frac{\Sigma q_o p_o}{T_o} \right) T_1}{\Sigma T_1} = \frac{\sum \frac{\Sigma q_1 p_o}{T_1} \cdot \frac{T_o \cdot T_1}{\Sigma q_o p_o}}{\Sigma T_1} = \frac{\Sigma q_1 p_o \frac{T_o}{\Sigma q_o p_o}}{\Sigma T_1}$$

We previously discussed the fact that the level of productivity "W" is inversely proportional to the time consumption of the product "t," or, that $W = \frac{1}{t}$. Let us recall that the number of time units put into the production of a unit of article or its time consumption "t" was

obtained by dividing the total worktime T used for the production by the total amount of this production "Q" or that $t = \frac{T}{Q}$.

In view of the fact that $w = \frac{1}{t}$, $w_1 = \frac{1}{t_1}$, $w_o = \frac{1}{t_o}$, the individual productivity index "i" equals

$$i = \frac{w_1}{w_o} = \frac{1}{t_1} : \frac{1}{t_o} = \frac{t_o}{t_1}$$

It can be seen from the above that the index for the dynamics of the productivity based on the time consumption of a uniform product is computed as the inverse of the index of the dynamics of the time consumption of that product.

Similarly computed is the index of the dynamics of productivity based on the time consumption for the production of various articles.

The index of the dynamics of time consumption for a group of varying articles is computed as the ratio of the amount of time necessary to produce this group of products during the time under study to the amount of time necessary to produce this group of products according to the time consumption during the basic period, according to the formula

$$I = \frac{\sum q_1 t_1}{\sum q_1 t_o} .$$

Since the index of the dynamics of productivity is the inverse of the index of the dynamics of time consumption, it can be computed from

$$I = \frac{\sum q_1 t_o}{\sum q_1 t_1} .$$

This index measures the change in productivity by the change in the amount of time necessary to produce the same group of products produced during the period under study.

Since $t_1 = \frac{T_1}{q_1}$, and therefore $T_1 = q_1 t_1$, we can rewrite the above equation as

$$I = \frac{\sum q_1 t_o}{\sum q_1 t_1} = \frac{\sum q_1 t_o}{\sum T_1} .$$

From the theoretical standpoint this index is the best measure of the dynamics of productivity, since the amount of accomplished production is measured on the basis of the time required to produce it, hence in units defining the time consumption of the production.

The application of this index in practice however encounters many difficulties because the records lack accurate data regarding the time put in by all the workers of the enterprise into the production of the given article. As is known, records pertaining to the worktime used in the production of a given article are kept by enterprises only for articles which are subject to norms. Worktime records obviously concern only outlays of live labor and do not record labor outlays represented and carried over in the produced article. In this connection this index correctly shows the dynamics of productivity only in relation to an unchanged group of articles produced during the period under study, "$\sum q_1$."

It is easy to confirm that in a case where the average time consumption per unit of the product was higher during the basic period than it is during the period under study or when $t_o > t_1$, the numerator of the index will also be larger than the denominator, or $\sum q_1$ to $\sum q_1 t_1$, and the value of the index will be larger than one, which means that the productivity during the period under study increased by comparison with the basic period. Inversely, when $\sum q_1 t_o$ is smaller than $\sum q_1 t_1$, the productivity in the period under study was lower than for the basic period.

4. Statistics of Work Norm Fulfillment

Connected with the study of productivity is the study of the fulfillment of work norms by workers employed in work for which norms have been established.

Work norms define exactly the outlay of work for a given productive problem, for example, the number of minutes for weaving one m of cloth, for the processing of a part in the machine, etc.

Norms should be just and encourage the worker to raise his productivity. Norms established "by sight" or by estimate are neither just nor encouraging. Neither are norms established by the so-called statistical method on the basis of statistical data concerning the time consumption up to that time needed for the given production problem, since such norms take into account the high productivity of leading workers alongside the low productivity of the slow worker but do not take into account technological progress or changes in the organization of work. The most just norms are the ones based on scientific analysis of the production possibilities of equipment and work organization, on detailed study of the work methods of the larger and well functioning groups of workers, and on computations of the time used by them for the fulfillment of the industrial task with the aid of operational time study and photographs of the working day. Norms established in this manner are called technical norms.

Speaking at the Nineteenth Convention of the CP USSR, G. M. Malenkov said: "The establishing of technical norms is of great value in the raising of productivity. Up to this time the establishing of norms in many enterprises has not been satisfactory. There is still a prevalence of too low norms, the so-called experience and statistical norms, which do not correspond to the present-day level of technological production, do not reflect the experience of the leading workers, and do not build up productivity. The

percentage of experience and statistical norms is very high and in some enterprises accounts for more than 50% of the binding production norms" (Nowe Drogi, Special No, 1952, page 38).

A study conducted in the machinery industry in Poland showed that in 1952 over 85% of the binding norms were statistical, and barely 15% were technical. Furthermore these statistical norms had not been changed for 3 years, despite the considerable technical progress made in the Polish machinery industry during that period. (See Blinowski, Franciszek, "Some Wage Problems," Nowe Drogi, No 6/48, 1953 pages 52-53). As a result of this state of affairs, the average norm fulfillment, for example, in the Ministry of the Machinery Industry in December 1962 amounted to 185.7%.

Statistical data regarding the average norm fulfillment signalled a disquieting situation in the establishment of norms in some fields and brought to light significant productivity reserves and the necessity to revise and bring work norms up to date.

The phenomenon of work norm fulfillment therefore requires constant and systematic statistical supervision.

According to GUS instructions, binding since 1954, industrial enterprises each month submit reports on the work norm fulfillment according to Model 1/VI.

Part I

MODEL 1/VI

Position number	Itemization	Worked Man-hours: For work both subject and not subject to norms	Worked Man-hours: Including for work subject to norms	Percentage of work subject to norms (4÷3)x100	Man-hours allowed by norm	Average % of norm fulfillment
1	2	3	4	5	6	7
1	Workers of group* ---(Position 2-15)					

*Industrial, development, manufacturing.

Part II

MODEL 1/VI

Position number	Itemization	Number of Workers by % Norm Fulfillment: Total (Col 4-8)	Below 100	100-119	120-149	150-199	200 and over	Number of Paid idle man-hours of norm workers
1	2	3	4	5	6	7	8	9
1	Workers of group* --- (Position 2-15)							

*Industrial, development, manufacturing.

According to this instruction, the % of worknorm fulfillment is computed on the basis of (1) quantity norm (product norm) and (2) Time Norm, including (a) for one operation, and (b) for many operations, and the mean % of worknorm fulfillment on the basis of various quantity norms or on the basis of the simultaneously applied quantity and time norms in relation to several departments or plants.

The index for the quantitative (product) norm fulfillment for a worker serving in one post is computed by dividing the amount of production completed by the worker during the period under study by the amount of production which the worker was supposed to have completed during this period according to the established norms. The formula for computing the index is

$$W = \frac{q_1}{q_n} \times 100,$$

where W is the index of norm fulfillment,

q_1 actual production for period under study, and

q_n amount of production which should have been completed during this period according to binding norms.

For example, let us assume that a worker should according to the binding norm complete in one hour 10 kg of nails. Figuring that the worker works 200 hours during the month, q_n will then amount to 200x10 = 2,000 kg. If the worker produced during the month 2,400 kgs of nails, the index of norm fulfillment amounts to

$$\frac{2,400}{2,000} \times 100 = 120\%.$$

The index for the time norm fulfillment for one operation is computed by dividing the amount of time needed for the completion of a unit of the product according to the norm by the amount of time actually

consumed in the completion of one unit of production. Expressed in the form of an equation, it is

$$W = \frac{t_n}{t_1}$$

where t_n is the amount of time needed to complete unit of product according to the norm, and

t_1 is the amount of time actually used for the completion of one unit of the product during the period under study.

For example, let us assume that according to the norm 4 coats should be sewn in one day, or the time norm for the sewing of one coat is $8 \div 4 = 2$ hours. Let us further assume that the worker worked 200 hours during the month and that he sewed during that period 125 coats. The actual average time used for the sewing of one coat amounts to $200 \div 25 = 1.6$ hours. The index for the time norm fulfillment is

$$\frac{2}{1.6} = 1.25 = 125\%$$

The index for the time norm fulfillment for several different operations is computed according to the equation

$$W = \frac{\Sigma\, q_1\, t_n}{\Sigma\, q_1\, t_1}$$

where q_1 is the actual amount of production completed during the period under study.

(See example on Page 254)

Since the actual time worked during the period under study, T_1, equals the amount of production times the average actual time consumption per unit of production $q_1 t_1$, we can rewrite the equation thus:

$$W = \frac{\Sigma\, q_1 t_n}{\Sigma\, T_1}$$

and from the example given above $W = \frac{640}{570} = 1{,}12 = 112\%$

Example:

Name of product	Worktime Norm per unit of product in hours	Amount of production	Actual Time worked in hours	Time Allotted according to norm in hours
	t_n	q_1	T_1	$Q_1 t_n$
A	2	50	80	100
B	3	20	50	60
C	6	40	240	240
D	4	60	200	240
Total	x	x	570	640

In a case where the worker produced during the period under study various articles for which various quantity (product) norms had been established or in a case where the worker during the period under study performed operations for which quantity norms were established and operations for which time norms were established the index of worknorm fulfillment, according to the GUS instruction, is computed as the arithmetic mean of the indices of the various work norm fulfillments, weighted against the actual worktime during the period under study. Hence the mean index for the work norm fulfillment is computed as

$$\dot{W}_s = \frac{\Sigma W_1 T_1}{\Sigma T_1}$$

(See Example on Page 255)

Similarly is computed the index for work norm fulfillment for several work posts, departments, or factories.

Example:

Itemization	Norm		Norm Fulfillment		Actual time	Index of norm	Arbitrary
	Product in pieces	Time in hours	Product in pieces	Time in hours	worked in hours	fulfillment in %	quantity
	q_n	t_n	q_1	t_1	T_1	W_i	$W_i T_1$
Product A	5	--	6	--	40	120	4,800
Product B	4	--	5	--	10	125	1,250
Product C	6	--	9	--	50	150	7,500
Turning	--	2	--	1.6	20	125	2,500
Milling	--	5	--	2.5	50	200	10,000
Planing	--	6	--	5.0	30	120	3,600
Total	--	--	--	--	200	148.25	29,650

$$W_s = \frac{29,650}{200} = 148.25\%$$

Example:

Department	Time Worked in hours T_1	Norm Fulfillment index in % W_i	Arbitrary quantity $W_i T_1$
Foundry	16,500	132	2,178,000
Installation	19,200	148	2,841,600
Mechanical processing	15,600	125	1,950,000
Dismantling	8,300	149	1,236,700
Forge	11,500	153	1,759,500
Total	71,100	140.2	9,965,800

$$W = \frac{9\,965\,800}{71\,100} = 140{,}2\%$$

The index for time norm fulfillment for several workers can be computed according to the formula for the aggregate index:

$$\frac{\Sigma q_1 t_n}{\Sigma T_1}$$

where the time necessary to complete the production according to the norm is divided by the actual time worked. The aggregate index corresponds in this case to the index weighted against the arithmetic mean. Indeed, since $W = \frac{\Sigma W_1 T_1}{\Sigma T_1}$, $W_1 = \frac{q_1 t_n}{q_1 t_1}$, $T_1 = q_1 t_1$, then

$$W = \frac{\sum \frac{q_1 t_n}{q_1 t_1} \cdot q_1 t_1}{\Sigma q_1 t_1} = \frac{\Sigma q_1 t_n}{\Sigma q_1 t_1}$$

By means of the equation for the aggregate index it is also possible to compute the mean index of quantity and time norm fulfillment after converting the quantity norms into time norms. In converting quantity into time norms we come out with the assumption that the time norm is the inverse of the quantity norm. Conversion is done according to:

$$t_n = \frac{1}{q_n}$$

If, for example, according to the quantity norm a worker should produce 6 chairs during one hour, then the time norm t_n for the production of one chair will be $\frac{1}{6}$ hours or 10 minutes. If during a given month 1,000 chairs were produced, then the time allotted by the norm equals 1,000x10 = 10,000 minutes. Dividing the allotted time by the actual time worked, the index of the norm fulfillment is obtained.

Since the quantity norm is the inverse of the time norm, each decrease in the time norm is followed by an increase in the quantity norm, and vice versa, for each increase in the quantity norm there is a corresponding decrease of the time norm. If then a decrease in the time norm by x% occurred, then the quantity norm rose simultaneously by y%.

It is important to note however that the percentage decrease of the time norm is not the same as the percentage increase of the quantity norm.

The interdependence between the percentage of decrease in the time norm, x, and the percentage of increase in the quantity norm, y, can be computed from the following equations:

$$x = \frac{100\,y}{100 + y}; \quad y = \frac{100\,x}{100 - x}$$

Example 1. Let us assume that the time norm decreased by 30%, or x = 30%. The percentage of the increase in the quantity norm will amount to

$$y = \frac{100 \cdot 30}{100 - 30} = 42{,}85\%$$

Example 2. Let us assume that the quantity norm rose by 50%. The corresponding lowering of the time norm x% will amount to

$$x = \frac{100 \cdot 50}{100 + 50} = 33{,}33\%$$

All the above methods are used to compute only the fulfillment index of shifting norms. In applying these methods to completed production, faulty production for which the worker is not responsible is not included, and the actual worked time includes paid-for idle man-hours. Furthermore, in computing the amount of time necessary for the production of articles according to the norm ($q_1 t_n$), only the time foreseen in the basic norm is brought into account, but no consideration is given the time defined by the additional norm, which foresees an additional work outlay in connection with existing deviations from normal conditions of production. Therefore the magnitude of the index for the fulfillment of the shifting norm is affected, not only by the degree to which the workers mastered the norm, but also by other factors connected with the organization of work in the enterprise.

In order to compute the index of mastering the work norm, or the so-called index of hourly norm fulfillment, it is necessary to add to the amount of completed production the rejects which arose through no fault of the worker, to deduct from the actual worked time the number of idle man-hours, and to bring into consideration the additional norm.

Hence the index of shifting norm fulfillment, W_z, equals:

$W_z = \frac{\text{(usable production)x(basic time norm)}}{\text{(actual time worked)+(paid idle time)}}$, and the index of hourly norm fulfillment, W_g, equals:

$$W_g = \frac{\text{(usable production+rejects)x(basic time norm+additional norm)}}{\text{(actual time worked)-(paid idle time)}}$$

The index of shifting norm fulfillment shows the actual work norm fulfillment, whereas the index of hourly norm fulfillment is analytical in nature and states the possibilities for norm fulfillment after existing shortcomings in the organization of work have been eliminated.

The manner of computing the hourly and shifting norm fulfillment indices is shown in the following example:

Name of product	Time Norm per Unit of product in man-hours		Production in Pieces		Allotted Time			Actual Time Worked	
	basic	additional	usable	rejects not the worker's fault	for usable production according to norm: basic	additional	for rejects	at normed operations	lost in paid idle time
1	2	3	4	5	6	7	8	9	10
	2	-	100	-	200	-	-	150	30
A	3	-	50	50	150	-	150	200	20
B	6	1	200	-	1,200	200	-	1,050	-
C									
Total	x	x	x	x	1,500	200	150	1,400	50

The index for hourly norm fulfillment equals $\frac{1{,}550+200+150}{1{,}400} = \frac{1{,}800}{1{,}400} = 1.285 = 128.5\%$.

The index for shifting norm fulfillment equals $\frac{1{,}550}{4{,}450} = 1.065 = 106.5\%$.

Characterization of work norm fulfillment by the employee cannot be based exclusively on data of the mean percentage of norm fulfillment. As is known, mean figures conceal both the facts of high overfulfillment as well as those of underfulfillment by part of the workers. In this connection there arises the need to group workers according to the percentage of work norm fulfillment.

The manner of grouping workers according to percentage norm fulfillment is shown above. In the report model in columns 3-8, where the grouping follows a prior grouping of the workers by occupation or by production departments, or by aggregate groups or by kinds of production (column 1).

VII. WAGE STATISTICS

I. Osipow

1. General Concept of Wage Statistics

A. The Concept of Wages

The subject matter of studies of wage statistics is the payment of wages received by workers employed in industrial enterprises. Statistics of wages extends these studies first of all to cash payments received by the workers and for some other material compensation for the benefit of the workers (such as fuel allotments, housing, light, etc) included in the list of wages according to their monetary value.

Cash payment in the socialist regime consitutes the basic form of division of the part of national income earmarked for living expenses. Cash payment basically represents that part of the national income which workers receive or the satisfaction of their individual needs. Over and above that, workers also benefit from that part of the national income which is earmarked for social use. As is known, in the socialist system workers benefit from a widely built up system of social security, the cost of which is borne by the enterprise, from free instruction, from recreation, nurseries, mother and child care, and other services. That part of the consumption fund earmarked for public consumption is not included in statistical studies of wages. Hence the subject matter of statistical studies of wages are essentially only "nominal" wages expressed in monetary units, that is, in currency zlotys, and not the so-called "real" wages which are the subject of general economic statistical studies.

In the capitalist system wages represent the price that the capitalist pays to buy labor, which is a commodity. Work there reflects the basic action of the contemporary capitalist law, the essence of which is the insurance of the maximum profit for the capitalists by way of exploitation, ruin, and impoverishment of the majority of the population of a given country. Wages in the capitalist system express the inconsistent contradiction between the social form of creativity and the private form of acquisition of the produced goods as well as the division of worktime into a paid and an unpaid-for part.

In the capitalist system, in the pursuit of maximum gain, there is furthermore applied a system of unequal pay for equal work, for example, in relation to juveniles, women, "colored" workers, natives in the colonies, immigrants, etc.

In the socialist system wages constitute the basic form of dividing the goods among workers free from exploitation. In socialist society there is a binding duty for everyone to work according to his ability and the binding principle that everyone shall be paid according to his work. This principle found its expression in Article 14, Statute 3, of the Polish Constitution, which states: "The Polish People's Republic evermore applies in life the principle: 'from each according to his ability, to each according to his work.'"

The principle of the right of all workers to pay according to their work has nothing to do with equalization of pay. Small-town ideas "still prevail in Poland," said Boleslaw Bierut at the Seventh Plenum of the Central Committee of the Polish Peoples' Worker's Party, "that wages should be equalized regardless of whether it is light or heavy, skilled or unskilled."

There are still people among us who think that we can tolerate a state of affairs where the difference in pay for a skilled and unskilled worker is slight, or a state where the pay of an engineer is not only slightly larger than that of a skilled worker but is sometimes even lower. These ideas are indeed false, anti-Leninist, and contradictory to the principle of the definition of workers wages in accordance with the work in a socialist system" (Nowe Drogi, No 6/36, 1952, pages 30-31).

Equalization of wages is harmful, since it nullifies the significance of the workers personal material interest in the results of his work, which is one of the main incentives of human activity and one of the main factors in the growth of productivity. Therefore wages in the socialized system are not equalized but differentiated according to the quantity and quality of the work performed by the worker. This means that wages grow in accordance with the quantity of performed work, measured either by the time of its duration or, which is even more just, by its productivity. Skilled labor requiring definite abilities is higher paid than unskilled labor. And for heavy labor performed under trying conditions one gets higher pay than for light work or work performed under ordinary conditions.

B. The Wage Scale

Realization of the principle of correct and just differentiation of wages is accomplished by means of wage scales and qualification raters.

Wage scales establish for the various occupations a number of qualification levels, or the so-called category grades, according to differences appearing in the qualifications of the workers of a given occupation. Wage scales also establish the amount of renumeration, or the basic pay rate per hour work of the unskilled worker of the first, that is, lowest, category. Wage scales are based on a so-called coefficient of qualification for the various category grades. Multiplying the base pay

rate of a worker of the first category by the qualification coefficient, his own basic pay rate is obtained.

Example (arbitrary):

Category Grade	I	II	III	IV	V	VI	VII	VII	IX
Coefficient of qualification	1.00	1.10	1.21	1.35	1.50	1.68	1.87	2.10	2.3
Basic pay rate in zlotys	2.00	2.20	2.42	2.70	3.00	3.36	3.74	4.20	4.70

On the basis of the wage scale and data regarding the number of workers or the time worked by them according to the various category grades, it is possible to compute the so-called average coefficient of qualification, as the arithmetic mean of the various qualification coefficients, weighted against the number of workers (or worktime put in by them) in the given category grade. The growth of the average qualification coefficient is also expressed as the average growth in the qualifications of the workers, and as the dynamics of their wages.

Example:

Category Grade	I	II	III	IV	V
Qualification coefficient	1.00	1.10	1.20	1.35	1.50
Number of workers	20	30	50	40	60

The average qualification coefficient equals:

$$\frac{(1.00x20)+(1.10x30)+(1.21x50)+(1.35x40)+(1.50x60)}{20+30+50+40+60} = \frac{20+33+60+54+90}{200} = \frac{257}{200} = 1.29$$

In a similar manner the average base rate of pay is computed.

The average qualification coefficient as well as the average base rate of pay can be computed only for workers paid according to the same wage scale. The computation of these indices for workers paid according to various wage scales is impossible.

By comparing the magnitude of the smallest and largest pay rate of the category grades, we get an idea of the margin of the wage scale. The growth of this margin as well as the margin between the various consecutive category grades indicates the progress in the struggle to eliminate equalization of pay. "Thus, for example, this margin in the metallurgical industry amounted to from 1.00 to 2.20 in 1949 and already amounts to from 1.00 to 2.93 in 1950. In coal the margin for 1949 was from 1.00 to 2.13 and in 1952 from 1.00 to 3.06" (Nowe Drogi, No 6/36, 1952, page 30).

The kind of qualifications required of a worker in order to include him in a certain category grade as well as those needed for the performance of a given job are determined by the so-called qualification rater. The classification rater contains the following in detail.

a. Names of occupations

b. Description of the operations with special note of working conditions and the required precision of its performance

c. Abilities essential for the performance of these tasks

d. Responsibility for work performed

e. Definition of the category of a given job, on the basis of which the base pay rate is established according to the scale

It is necessary to distinguish between the personal grading of a worker and the category grading of a defined operation, or job. With effective work organization in an enterprise, an operation graded in a

certain category is performed by a worker personally graded in this category. Performance of lower category operations by workers of higher personal grading indicates poor work organization. Such facts are a source of waste of means of production and the cause of excesses in wage funds as well as nonfulfillment of lowering of the operating cost quota, all of which may also happen when a worker is included without reference to higher qualification grades, distorting the principle of just renumeration according to the quantity and quality of work performed.

C. The Pay System

There are 2 basic systems of pay according to the principle used in wage computation, (a) time work and (b) piece work.

In time work, the amount of pay the worker receives depends upon the amount of work put in by him and upon the category in which he is personally graded. The amount of pay is therefore directly proportional to the amount of time he worked or spent on the job. If the pay rate calls for pay for a month's work, the worker receives his pay for each month spent on the job regardless of the actual number of days he was present during the month. With a daily rate of pay the worker receives wages for every day he spent on the job regardless of the number of hours he worked. With an hourly rate of pay the worker gets paid strictly in accordance with the number of hours he worked. It is true that in the application of the hourly rate of pay one realizes to a greater extent the principle of pay according to the amount of work (measured in the time of its duration) performed than in daily and especially monthly rates of pay, since in daily rates, and especially in monthly ones, there is an ever increasing obliteration of the boundaries between work performed and omitted time.

We have, then, 3 kinds of time work pay, (a) hourly, (b) daily, and (c) monthly.

The time work system of pay is not fully consistent with the principle of the socialist society calling for "to each according to the amount and quality of his work." The time work system covers only the quantity of time measured by its duration but does not fully cover the quality of performed work. Furthermore this system does not furnish an incentive for the personal interest of the worker in the results of his work. Therefore the time work system of pay is being applied to a smaller extent and only in those cases where the amount of work performed can be measured only by its duration and not by its results (for example, guards or service workers).

Besides the ordinary time work system, there is also a premium time system which consists of the fact that the worker receives over and above his regular time additional pay for certain qualitative indices achieved at work, for example, the premium received by machinists and electricians on duty for the accident-free operation of the machines and equipment, the premium paid to workers for savings in materials, fuel, etc. The premium time system, as can be seen, is a higher form of wage payment in comparison to the ordinary time work system.

Most suitable to the principles of socialist division by quantity and quality of work is the piecework system of pay, wherein a worker is paid according to the amount he produced and according to the rate of pay per unit of production. In this system, the worker's pay depends therefore, not on the amount of time spent at work, but exclusively on the results of this work, on its quantity and quality, hence on its productivity.

In the piecework system, the worker is directly and materially interested in the result of his work. This system contributes to the raising of quality and of productivity, and serves as an incentive to improve the qualifications of the worker. In order to encourage workers to transfer

to a piecework system of pay, collective work contracts provide for a certain addition of 10%-15% in the base pay for a transfer to the piecework system, or the so-called piecework encouragement.

In the regular piecework system (pure piecework) the worker's pay is directly proportional to the quantity of produced articles. If, for example, a worker receives 10 zlotys, for the processing of one part on a machine, then when he processes 50 parts he receives 500 zlotys, and when he processes 150 parts he receives 1,500 zlotys. In this system the rate of pay for the production of a unit article remains unchanged regardless of the amount of produced articles.

In the progressive piecework system the worker's pay depends also on the degree of norm fulfillment. This means that on exceeding the norm the worker gets progressively more for each unit of production above the norm than he received for units produced within the norm.

Example:

Percent of Norm Fulfillment	Pay Rate per Unit of Article
to 100%	10 zlotys
above 100% to 110%	13 zlotys
above 110% to 120%	15 zlotys
above 120% to 150%	20 zlotys

That part of the pay which the worker receives for exceeding the norm is called piecework surplus.

In progressive piecework the worker's pay for work above the norm rises more rapidly than his productivity. Therefore progressive piecework can be applied only in those cases where the necessity exists to overcome "bottle necks" in production, and an additional incentive to raise productivity is needed.

Piecework may be (a) individual or (b) group, according to the manner of pay computation.

In individual piecework the pay is computed according to the work performed by each worker.

In group piecework the pay is computed for the entire group (brigade) of workers, and is then divided among each member of the group according to the amount of time worked by each and according to his skill, or category grade. This system is applied in cases where the kind of work requires its performance by a group of workers.

D. Pay Records

The total amount paid as wages in an industrial enterprise is included in the so-called payroll. The payroll contains a listing of all the employees by name and the amounts paid to them as wages, and is usually composed of 4 parts, (a) part 1 contains record number, name in full of worker, period of work, and pay rate or salary, (b) part 2 covers gross earnings, (c) part 3 lists all the deductions from the pay, and (d) part 4 contains the net pay which the worker receives and receipts.

Wages of workers who get paid by the month (administrative and office workers, etc) is computed directly on the payroll sheet, but the amount of pay due laborers is established on the basis of the so-called work card. The work card includes, among other things, (a) the worker's record number and full name, (b) rate of pay of the worker or the operation, (c) description of the kind and duration of the operation, and (d) actual put-in time or number of produced articles.

There are many kinds of work cards, for example, earnings, instructions, or operation.

The earnings card includes all work done by the worker in a given period (week, 10-day, monthly) and at the same time furnishes a complete picture of his earnings for that period.

The instruction card contains the instruction to perform certain work for several workers.

The operation card contains the instruction to perform a separate job (operation) by one worker.

E. Tasks of Wage Statistics

In a socialist society the planning of the national income comprises not only the total amount of the national income, but also its division into accumulation and consumption. The basic part of the consumption fund passes directly to the workers for individual disposition in the form of wages. It is clear that exceeding the planned limits of the wage fund causes, in an unchanged national income, a corresponding curtailment of the accumulation fund which, in turn, threatens the social reproduction process itself on a broadened scale. Exceeding the planned consumption fund and consequently the planned limits of wages may occur only by exceeding of the planned level of productivity at the same time, and at that the dynamics index of productivity should be higher than the index of the dynamics of wages.

From the standpoint then of the national economy the most important task of wage statistics is the statistical supervision of the wage fund quota fulfillment, and specifically the bringing to light by means of statistical analysis facts of true excess of the plan limits at an apparent quota fulfillment of the wage fund.

In view of the fact that the tempo of the process of broadened social reproduction depends, among other things, on the degree to which the index of productivity dynamics exceeds the index of wage dynamics, the next important task of wage statistics lies in the specific study of wage dynamics.

Another task of wage statistics is the study of the wage fund structure by pay systems, and specifically the portion of the total wages paid out by the piecework system, as well as the breakdown of wages by occupations and grade categories of workers.

Since paid wages in the socialist system to a certain extent reflects the action of the basic law of socialism, the aim of which is to insure the satisfaction of the constantly growing material and cultural needs of the entire population, wage statistics should study not only the dynamics of the average pay but also the dynamics of individual earnings in various groups of workers.

Finally, since from the viewpoint of the enterprise wages constitute a considerable element of the operating cost, wage statisticians have the task of studying the part wages play in the total gross value of production and the dynamics of the wage consumption of various products.

Wage statistics data are of importance also in other branches of industrial statistics, since they reflect the state of work organization in the enterprise, the degree of utilization of worktime reserves, etc. Data, for example, on idle time payments, on overtime pay, on defects not of the worker's fault, on extras paid to a worker of a higher grading for lower grade work, etc indirectly characterize the work organization within an enterprise.

2. The Wage Fund

A. The Concept of the Wage Fund

In order to conduct constant and systematic statistical supervision of the quota fulfillment of the wage fund and of its structure as well as the dynamics of wages, it is essential to have a strictly defined concept of the wage fund.

Basically the wage fund is charged with every kind of renumeration paid to workers employed in an enterprise for work performed by them, or for the time they worked, or renumeration due to workers in accordance with legal regulations or with collective contracts. In accordance with the binding regulation, the workers wage fund covers their base as well as supplementary pay.

Basic pay generally speaking is the renumeration paid the worker for work performed or for the time of work.

Basic pay consists of (a) fundamental pay and (b) extra pay.

Fundamental pay includes payment for work performed or time worked, depending upon the pay system used. Fundamental pay includes then piecework pay and eventually the piecework incentive pay as well as the piecework premium or time work pay, hourly, daily, or monthly, as well as equalizing, local, functional, service, and special supplements.

Extras include extra pay of all kinds in payment of performed work or worked time.

Specifically extra pay includes the following.

a. Extras from piecework progression
b. Premiums paid in accordance with binding premium regulations

c. Extra pay for overtime and holiday work

d. Extra pay for nightwork or for work under difficult and hazardous conditions

e. Extras for brigade leaders for leading the brigade

f. Extras for intraplant instruction and training of apprentices

g. Extras for years of service, for example, resulting from "mining cards"

h. Pay for idle time and for rejects not the worker's fault

i. Extra pay in connection with performing work of a lower grade than the employee's regular classification or extras as a result of deviations from the planned production process (for example, working with a different material or working at a different workpost).

Complementary pay comprises pay for vacation or circumstantial leave, for absence connected with fulfilling social or state obligations, as well as lump sum pay ments to social inspectors for running the loan and mutual aid funds, for care of efficiency promoting clubs, etc.

Complementary pay also comprises payment for time paid to feeding mothers, for unworked time of studying juveniles and other workers delegated for schooling or training, as well as discharge pay to workers released from the job, for example, for military service.

Complementary pay further includes the value of free uniforms as well as the value of allotments and of services (housing, heating, light, etc) paid for by the enterprise for the workers regardless of whether they are paid in goods or in cash.

The value of free uniforms issued the workers is charged to the wage fund at a rate of the monthly depreciation of the uniform.

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The value of allotments regardless of when it was issued to the worker and the value of free community services are charged to the wage fund in amounts accepted on the payroll, in accordance with binding regulations for the computation of pay taxes.

Since the size of the wage fund for the period under report should reflect all payments made as wages, it is not permitted to decrease the total payments by any kind of pay deduction, for example, taxes, previously drawn advances, installments due on loans borrowed from workers mutual and loan banks, and other legally approved deductions.

On the other hand the wage fund should not include payments which do not constitute renumeration for performed work but for material use. In connection with this, in accordance with the instruction regarding the items belonging in the wage fund of 10 January 1953 constituting an amendment to Statute No 53 of the Government Presidium in the matter of increased supervision of the wage fund in the socialist economy (Monitor Polski, No A-15, position 210), if a man does work entrusted to him using his own equipment and tools or horses, then the wage fund is charged only that part of his fee which is considered to be payment for the work he performed. The amount paid him however for the use of his equipment, tools, or horses is not charged to the wage fund.

The wage fund is charged with all payments for wages discussed above regardless of the source of financing and regardless of the form of voucher on which it is paid (payroll, bill).

The wage fund includes all wages for work planned, as well as work performed outside the plan.

The wage fund for a definite period (month, quarter, or year) should include all amounts computed due and passed for payment during that

period, even though the indebtedness may have pertained to a prior period.

Employees premiums are included in the wage fund for that month during which they were paid.

Not all payments made on behalf of the workers of the enterprise are included in the wage fund.

Not included, for example, are the cost of insuring the workers in the social insurance fund in case of illness, disability, unfortunate accidents at work, etc which are borne by the enterprise and which are computed on an established percentage basis of the pay. This procedure is justified because the worker receives these benefits indirectly and not during the report period, but on the occurrence of, for example, an accident, and not directly but as, for example, temporary disability benefits, etc. The circumstances where these payments are made by proxy by the enterprise into the social insurance fund, are not relevant.

Neither should one include in the wage fund other payments covered by the plan for social services, such as the following.

a. Transportation and board of newly recruited workers as well as separation supplements in the coal industry for workers living in doss houses.

b. Refunds for school fees.

c. Awards to anniversary heroes.

d. Posthumous discharge payments.

e. Payments associated with 'Miners Day, Metallurgists Day' and 'Stokers Day.'

f. Annuities and pensions paid by factories.

g. Value of clothing supply for graduates of vocational training schools.

h. Value of maintenance issued partly or totally free, according to binding regulations, as well as the value of nourishment rations issued to workers employed in harmful or difficult conditions of work.

i. Value of clothes issued fully or partly free of charge, according to binding regulations.

Furthermore, the wage fund does not absorb one-time awards from factory or award funds as well as one-time premiums for results achieved in work competitions.

These premiums and awards are accorded for general results attained at work according to the decision of the organs in charge of these funds, and in case of failure to receive such prizes or awards (for example, in connection with the holiday of the Polish Resurrection on 22 July, with the International Woman's Day on 8 March, etc) the worker has no right to press his claim through the courts.

These premiums are of an entirely different nature than the premiums paid out periodically according to binding regulations for achieving or overreaching planned indices, for example, for the quality of production, for savings in materials or fuel, for diminishing idle time, for accidentless operation, etc, nonpayment of which entitles the worker to legal recourse through the courts, and for this reason these premiums as a composite part of the worker's renumeration are entered in the wage fund.

Neither should the wage fund include payments which are the equivalent of expenses paid to workers for work incurred in the service

of the enterprise, for example, food, transportation, and additional expenses by authorized personnel.

Finally, the fund should not include payment of scholarships or renumeration paid to students of schools for vacation practice, since these payments do not constitute wages for work performed, but are rather in the form of assistance which the people's state extends to studying youth.

Monthly statistical reports also cover the so-called impersonal wage fund.

The impersonal wage fund includes renumeration of all kinds paid for occasional work of short duration, paid to people who are not on the payroll records of the enterprise or to regular enterprise employees in cases where the work performed does not fall within the scope of the enterprise's regular activity.

In particular the impersonal wage fund includes renumeration for all occasional work, for example, loading, unloading, payment for work ordered, for consultation and expert advice, participation in commission sessions, and renumeration of part-time employees (legal advisors, physicians, etc).

B. The Grouping of the Components of the Wage Fund

In computing the level and dynamics of the average pay, the components of the wage fund are grouped according to the grouping of the workers and the worktime pertaining to them.

The total of the wage fund for the period under study, for example, a month, is grouped according to the basic grouping applied in employment

statistics, hence, according to the division of workers into the industrial, not industrial, investment and capital repair, construction and assembly and other groups, and within the industrial group into laborers, engineering and technical workers, administrative and office workers, etc (see Model 1/VII).

In accordance with recorded standards of time payments we distinguish the hourly, daily, and monthly wage funds.

The hourly wage fund covers all payments concerning the actually worked hours during the period under study (for example, a month) under conditions of a normal day's work.

Specifically the hourly wage fund includes time work payments depending upon the actual hour worked, piecework pay including piecework system incentive pay and piecework surplus pay, and miscellaneous other payments connected with time actually worked or work actually performed, with the exception of extra pay for overtime or holidays, but with the inclusion of the straight pay for work done in those hours, the extras paid for work in the second and following shifts, extras for working in harmful or difficult conditions, extras for intraplant training, for leadership of brigades, for rejects not the worker's fault, and other premiums paid on the basis of binding regulations.

The daily wage fund comprises all payments of the hourly wage fund as well as payments for time not worked during the period under study which are included in the worked man-days. In particular the daily wage fund over and above the hourly wage fund includes payments for current (intrashift) idle man-hours, for interruptions in the work of feeding mothers, for man-hours omitted as a result of performing social and state duties, as well as extra premiums for overtime or holiday pay, etc.

MODEL 1/VII. WAGE FUND IN THOUSAND ZLOTYS*

Including Fundamental Wages

Serial Number	Itemization	Planned for report month	Actual for report month	Total	Base pay	Including piecework premium	Extra pay	including Bonuses	Overtime premiums	Actual from Beginning of year to end of report period	Average Pay per worker during report month in zlotys
1	2	3	4	5	6	7	8	9	10	11	12
1	**Total**										
2	**Including laborers**										
3	**Industrial group** (items 5+7 to 11)										
4	**Including in by-products**										
5	**Laborers**										
6	**Including permanent**										
7	**Engineering and technical workers**										
8	**Administrative and office workers**										
9	**Maintainance workers**										

1	2	3	4	5	6	7	8	9	10
10	Guards								
11	Students								
12	Non industrial group								
	Total								
13	Construction and installation investment and capital repair workers								
	Group total								
14									

*Carried to one decimal place.

The monthly wage fund comprises the entirety of the wage fund paid to workers, hence all payments of the daily fund as well as payments for whole-day stoppages, payment for omitted time for performing social and state duties, payment for vacations, value of allotments, uniforms and community services, pay of workers delegated to school and remaining on the payroll of the enterprise, bonuses for length of service, etc.

As is to be seen from the above definitions, the hourly wage fund contains only those components which constitute payment for actual work performed under conditions of a normal day's work (normal shift). However those components of the wages which do not meet these 2 characterizations, that is, which constitute payment for work not performed, or which constitute payment for work actually performed but not within conditions of the normal day (overtime and holiday premium) do not enter into the composition of the daily wage fund.

The daily wage fund is always larger than the hourly wage fund since it also includes pay for work performed but not under conditions of the normal workday, as well as pay for work not performed, that is, for omitted man-hours, but within the scope of a normal day's work. The daily wage fund therefore includes all components of the daily wage fund answering the 2 requirements listed above but not only one or the other of them.

The monthly wage fund also comprises those payments which do not meet either of the 2 above requirements and concern the time (man-days) spent by the workers outside the enterprise.

On the basis of data concerning the magnitudes of the various wage funds, the level and dynamics of the average pay is computed.

A comparison of the sizes of the various wage funds and the margin between them in a way characterizes the degree of utilization of the work force supply and the organization of work in a given enterprise.

Components of the wage fund are also grouped according to the system of pay, or according to the accepted forms for compensating the workers for their work.

We mentioned before that one of the main tasks of wage statistics is the study of what portion of the total fund is paid by the various pay systems and the study of the dynamics of the piecework system of pay in the various branches of industry.

The portion of each pay system in the total wage fund can be computed by various methods. The portion can first of all be established by means of the number of workers paid by the various pay systems. For example, an enterprise employs 1,000 workers. Of these 800 workers get paid on a piecework basis and 200 on a timework basis. The portion on the piecework payroll is 80%.

The application of this method encounters many difficulties in practice since one worker frequently received his pay on a piecework basis, part of the month and part on a timework basis.

Another way to get the degree of distribution is to compute the time (in man-hours or man-days) for which piecework was paid in relation to the total worktime paid all workers in the enterprise.

Both methods of computation show the degree of acceptance of both systems among the workers.

There is still a third method, which consists of computing the portions from data regarding the amounts paid by each pay system. This method however does not give the degree of spread of the 2 systems among the workers and the extent of piecework spread, since piecework is paid at an essentially higher rate than time work, and using this system of determination is bound to result in a distorted and artifically increased proportion for piecework labor.

In the field of popularization and acceptance of piecework pay industry faces grave tasks. That this system is still insufficiently accepted in industry witness the data given below for the Soviet Union and for the Polish People's Republic.

PIECEWORK SYSTEM IN INDUSTRY* IN PERCENTAGES

Branches of Industry	USSR In 1938	PPR In March 1952
Coal industry	82.1	45.9
Metallurgical industry	74.9	58.4
Machinery industry	71.2	59.9
Cotton industry	71.3	58.5

*See Nowe Drogi, No 6/36, 1952, page 156.

3. The Control and Analysis of Wage Fund Quota Fulfillment

In accordance with resolutions of the Government Presidium of 10 January 1953, No 53 for strengthening the control of the wage fund in the socialist economy and No 54 for bank control of government and collective industrial enterprises, trade, and service pay charged to the economic account (Monitor Polski, No A-15, 1953, position 210 and 211), factories and plants are required3 to submit to the bank controlling their activity quarterly reports approved by their supervisory units regarding

their wage fund with a division into monthly plans for their wage fund. A change in the plan may be made only with the authorization of the Government Presidium which may establish new bases for renumeration or with the authorization of the proper minister in cases of change in production problems or changes in the number of employed.

Industrial enterprises draw up monthly reports on wage fund plan fulfillment. The comparison of the data regarding the planned size of the wage fund with the actual expenditures during the period under study gives the absolute excess or saving in the planned wage fund. If, for example, the planned wage fund called for 100,000 zlotys and the actual expenditures were only 90,000 zlotys, an absolute savings of 10,000 zlotys was achieved.

It may however turn out that the absolute savings are purely illusory, since the enterprise may not have fulfilled its production quota. Let us assume though that the production quota for the given enterprise was 500,000 zlotys but that it actually produced only 400,000 zlotys' worth, in other words, that it completed its quota only by 80%. Correcting the wage fund quota by the quota fulfillment correction coefficient, we obtain the corrected wage fund plan of a value of 100,000x0.8 = 80,000 zlotys. Comparing now the corrected planned figure against the actual expenditures we get a relative overfulfillment of the wage fund quota of 10,000 zlotys. In a similar manner the relative savings in the wage fund plan can be determined.

The index of the relative savings or of the relative overfulfillment of the wage fund plan is computed according to the formula $x_1 \div x_o \frac{Q_1}{Q_o}$,

where x_1 is the actual wage fund,

x_o is the planned wage fund,

Q_1 is the valee of accomplished production, and

Q_o is the value of planned production.

Rewriting the above formula we obtain:

$$x_1 \div x_0 \frac{Q_1}{Q_o} = \frac{x_1 Q_o}{x_o Q_1} = \frac{x_1}{Q_1} \div \frac{x_o}{Q_o}$$

This means that the index of relative savings or overfulfillment of the wage fund plan essentially shows the changes which occurred in the ratio between the wage fund and the value of production ($x \div Q$), or in the percentage portion of the wage fund in the total value of production.

We obtain a similar result if we divide the index of the average wage plan fulfillment by the index of the average productivity (v) plan fulfillment, since in this case both the numerator, wage fund (x), as well as the denominator, production (Q), are divided by one and the same figure, namely the average number of employed during the period under study (T).

Example:

Serial No	Itemization	Plan	Fulillment
1	Value of production 'Q'	200,000	300,000
2	Wage fund 'x'	80,000	108,000
3	Average number of employed (T)	100	120
4	Average productivity '$v = \frac{Q}{T}$'	2,000	2,500
5.	Average wage '$S = \frac{x}{T}$'	800	900

In the above example the coefficient of the production plan fulfillment equals 300,000÷200,000=1.5. The corrected planned wage fund equals 80,000x1.5 = 120,000. The gained savings in the expenditures of the wage fund amounts to:

$$120,000 - 108,000 = 12,000,$$

or 10% in relation to the corrected planned wage fund,

$$\frac{108,000}{120,000} \times 100 = 90\%.$$

A similar result will be obtained if the index of the average wage plan fulfillment ($\frac{900}{800} \times 100 = 112.5\%$) is divided by the index of the average productivity plan fulfillment ($\frac{2,500}{2,000} \times 100 = 125\%$) $112.5 \div 125 = 0.90$ or 90%.

The described methods of analyzing wage fund plan fulfillment do not always give a correct picture of the truly achieved savings or the actual overfulfillment of the wage fund quota, for the value of this index is also affected by changes in the percentage part of carried-over value in the total value of production as well as all shifts in the structure of the planned variety of production.

For example, let us assume that an enterprise planned the production of 1,000 cotton shirts at 100 zlotys per shirt or a total value of planned production of 100,000 zlotys. The wage fund was planned at 30,000 zlotys on the assumption that the making of each shirt costs 30 zlotys. Let us now assume that the enterprise failed to obtain the proper kind of cotton cloth and purchased silk shirting of which 1,000 shirts were made at a selling cost of 200 zlotys per shirt. The value of the accomplished production was therefore 200,000 zlotys and the actual wage fund expenditures amounted to 45,000 zlotys. Computing the relative quota fulfillment of the wage fund according to the formula $x_1 \div x_0 \frac{Q_1}{Q_0}$ we get an apparent relative savings of the wage fund by the enterprise of 100%-75%=25% ($45,000 \div 30,000 \frac{200,000}{100,000} = 45,000 \div 60,000 = 75\%$).

Actually the enterprise effected no savings but on the contrary overran the planned wage fund by 50%. In the described situation there is no justification for correcting the planned fund by the coefficient of the production quota fulfillment since the increased value of the accomplished

production as against the planned production was caused solely by the increase in the carried over value (replacement of cotton with silk).

On the other hand shifts in the variety structure of production have a definite effect on the magnitude of the index of relative wage fund plan fulfillment. It is due to the fact that the percentage portion of wages in the production value of particular items varies. In other words various articles have a different "work-consumption," and the shifts in the percentage structure of the production variety affect in turn the size of the index of relative wage fund fulfillment which reflects changes occurring between the wage fund and the value of production.

The effect of changes in the structure of the variety of production of varying "work-consumption" on the wage fund fulfillment is illustrated in the following example.

(See example on Page 288)

As is seen from the above example, the enterprise gained a relative savings in the wage fund of 45,000-2,808=42,192 zlotys when we compute it on the basis of data concerning the production quota fulfillment and wage fund for each article separately. However when we correct the total planned wage fund for all items (that is, 194,000 zlotys) by the coefficient of total production quota fulfillment (that is, $\frac{1,100,000}{1,000,000} = 1.1$) we obtain a corrected wage fund of 194,000x1.1=213,400 zlotys. Comparing the corrected total wage fund with the actually expended one (that is, 214,000 zlotys) will reveal that the enterprise did not have any relative savings but on the contrary overfulfilled the planned and corrected wage fund by 214,000-213,400 = 600 zlotys.

EXAMPLE OF EFFECT OF CHANGES IN THE VARIETY STRUCTURE OF PRODUCTION

ON THE WAGE FUND PLAN FULFILLMENT

Products	Value of Production in Zlotys			Wage Fund in Zlotys			Savings	Overfulfillment	Total
	Plan	Fulfillment	%Plan fulfillment	Plan	Corrected for % production plan fulfillment	Fulfillment	(+)	(-)	savings (+) or over-fulfill-ment (-)
1	2	3	4	5	6	7	8	9	10
A	200,000	160,000	80	20,000	16,000	18,000		-2,000	
B	500,000	750,000	150	150,000	225,000	180,000	+45,000		
C	300,000	190,000	63.3	24,000	15,000	16,000		- 808	
Total	1,000,000	1,100,000	110	194,000	256,192	214,000	+45,000	-2,808	+45,000 - 2,808 = 49,192

It is true that the enterprise achieved a relative savings of 42,192 zlotys in the wage fund as is shown in the above computation conducted separately for each product. It is necessary however to keep in mind the fact that into the composition of the total value of production enter articles of varying "wage-consumption," namely that for each 100 zlotys of product "A" 10 zlotys of wage fund should be expended according to plan, for product "B" 30 zlotys, and for product "C" only 8 zlotys. The above example shows that while an overall 10% overfulfillment of production was achieved the quota for low wage absorbing products was underfulfilled whereas the quota for the most wage absorbing product 'B' was markedly overfulfilled. In this connection there occurred even an increase in the percentage portion of wages in relation to the total production value as compared with the plan from 19.40% ($\frac{194,000}{1,000,000}$ x 100) to 19.45% ($\frac{214,000}{1,000,100}$ x 100), despite the fact that the percentage portion of wages of product "B," playing the greatest part in the total value of production, to the total value of this product fell from 30% ($\frac{150,000}{500,000}$ x 100) to 24% ($\frac{180,000}{750,000}$ x 100). The index of relative wage quota fulfillment computed for the total value of production and total wage fund shows, in the given example, changes in the wage absorption of the various products as well as changes in the structure of the variety of achieved production as compared with the planned one.

In computing the collective index of relative wage fund quota fulfillment for all enterprises within the jurisdiction of one central administration or for all departments within one enterprise, one should also keep in mind the effect of changes of production structure on the magnitude of this index. The manner of computing the wage fund quota fulfillment index for several enterprises is illustrated in the example given below.

Example: (in thousand zlotys)

Plans	Valuation of Production Plan	Fulfillment	Wage Fund Plan	Fulfillment	Savings (-) or Overfulfillment (+)
No 1	2,000	2,500	800	900	-100
No 2	3,000	2,500	600	550	+50.02
Total	5,000	5,000	1,400	1,450	-49.98

In the above example, the relative savings or overfulfillment of the wage fund quota was computed in the following manner. The actual expended wage fund was compared with the planned one, corrected for the coefficient of production quota fulfillment for each plant separately. Thus plant No 1 achieved a savings of 100,000 zlotys:

$$900-(800\frac{2,500}{2,000}) = 900-(800x1.25)= 900-1,000 = -100,000 \text{ zlotys}$$

and plant No 2 overfulfilled its wage fund quota by 50,020 zlotys:

$$550-(600\frac{2,500}{3,000} = 500-(600x0.8333) = 550-449.80 = +50.020 \text{ zlotys},$$

and jointly for both plants a relative savings of 49,980 zlotys was achieved: -(100,000 thousand zlotys)+(50,020 zlotys) = 49.980 zlotys.

An entirely different result will be obtained if we compute the index of relative wage fund quota fulfillment jointly for both plants and not for each one separately. This method will show a joint overfulfillment of the wage fund quota of 50,000 zlotys, since the coefficient of production quota fulfillment equals 1 $(\frac{5,000}{5,000})$ and in view of this the relative wage fund overfulfillment of 50,000 zlotys remains unchanged.

Actually in the given example a relative savings of 49,980 zlotys was achieved in the total wage fund fulfillment quota. The apparent relative

overfulfillment in computing the index for both plants jointly is a result of shifts in the structure of production. The portion of plant No 2 in the overall production fell from 60% planned to 50% accomplished production whereas the portion of plant No 1 it rose from 40% to 50% and the "wage absorption" for the production value of this plant was relatively higher than the "wage absorption" for plant No 2, since it amounted to, according to the plan, to 40% ($\frac{800}{2,000}$ x 100), whereas in plant No 2 it amounted to only 20% ($\frac{600}{3,000}$ x 100).

The magnitude of the index of relative wage fund quota fulfillment is also affected by the percentage portion of the various pay systems in the total wage fund. As is known, workers doing nonnormed work and paid on timework basis (daily, monthly) receive a steady wage regardless of the degree of the production quota fulfillment in the enterprise in which they are employed. Since the size of their payroll is constant it is clear that the relative portion of their pay in the total wage fund diminishes when the enterprise overfulfills its production quota and the corrected planned wage fund increases. On the other hand, when the enterprise underfulfills its production quota and the corrected planned wage fund quota decreases, the relative portion of their pay in the total wage fund increases.

(See Example on Page 292)

In the above example the total wages paid pieceworkers increased in January as compared to the plan from 45,000 to 52,650 zlotys corresponding to the production quota fulfillment coefficient (1.17), whereas the total wages paid to time workers by the day remained at 15,000 zlotys. In view of the fact that the correction of the wage fund by the production quota fulfillment coefficient pertains to the whole of the wage fund, it is indeed true that in this case the enterprise may show a relative savings

Example*:

Months	Wage Fund Plan			% Production quota fulfillment	Wage Fund Fulfillment			Corrected wage fund	Savings (-) Overfulfillment (+)
	Total	Piecework	Daily Wage		Total	Piecework	Daily Wage		
January	60,000	45,000	15,000	117	87,650	52,650	15,000	70,200	-2,250
February	60,000	45,000	15,000	75	48,750	33,750	15,000	45,000	+3,750

*Kukulewicz, I. L., and Rubin, M. A., Planowanie i analiza wskaznikow pracy [Planning and Analysis of Work Indices], 1950, Polskie Wydawnictwa Gospodarcze, pages 212-213.

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of the wage fund fulfillment. The opposite happened in February when the enterprise did not fulfill its production quota. This had to cause a relative overfulfillment of the wage fund quota because of the unchanged, in relation to the plan, pay to workers paid by the day.

In order to eliminate partially the influence of changes in the proportion of payments made by the various pay systems in the total wage fund on the index of relative quota fulfillment of the wage fund, it is necessary to analyze this fulfillment on the basis of the submitted statistical reports separately for the subgroups of laborers and separately for the other groups whose work is primarily not done in piecework (for example, maintainance workers, guards).

It is not always necessary to analyze the wage fund quota fulfillment in conjunction with the production quota fulfillment of a given enterprise since in some branches of industry wage fund expenditures continue even in periods when production is not going on for example during the spring and summer in the sugar industry when machinery and equipment repairs are going on and the sugar mill does not produce sugar. In such cases it is necessary to analyze the wage fund quota fulfillment in conjunction with the employment and worktime quota fulfillment.

After establishing the fact of the relative overfulfillment of the wage fund quota (or the achievement of the relative savings) it is essential to bring to light the reasons that caused it. Generally speaking, wage fund quota underfulfillment may be caused by changes in the planned average number of employees or in the planned average wage or in both, since the wage fund is the product of the number of employed by the average wage and changes in these factors cause a change in the magnitude of the wage fund. Denoting the wage fund with "X", the average wage by "S" and the average number of employees by "T," we may write the equation for the

planned wage fund as $X_o = S_oT_o$ and the actual wage fund as $X_1 = S_1T_1$.

By means of the so-called method of chain substitutions we can compute separately the influence of each of these factors on the change in the magnitude of the wage fund while keeping the second factor constant. On this basis the effect of the change in the average wage on the magnitude of the wage fund is computed from the formula

$$\frac{S_1T_o}{S_oT_o},$$

the effect of a change in the number of employed from

$$\frac{S_oT_1}{S_oT_o},$$

and the effect of a change in both factors from

$$\frac{(S_1-S_o)\ (T_1-T_o)}{S_oT_o}.$$

Example:

Itemization	Plan	Fulfillment	% Fulfillment
Average number of employees T	50	60	120
Average pay of one worker S	800	900	112.5
Total wage fund X	40,000	54,000	135

A change in the number of employees only, with a constant average pay, results in an increase in the wage fund of:

$$\frac{800x60}{800x50} = \frac{48,000}{40,000} = 1.2 \text{ or } 120\%, \text{ or an increase of } 20\%.$$

A change in the average pay only, with the number of employees constant, resulted in an increase in the wage fund of:

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$\frac{900x50}{800x50} = \frac{45,000}{40,000} = 1.125$ or 112.5% or an increase of 12.5%.

A simultaneous change in both factors caused a further increase in the wage fund of 1,000 zlotys: (60-50) (900-800) or 2.5% $(\frac{1,000}{40,000} x100)$, and the wage fund increased altogether by 35% (20%+12.5%+2.5%).

In further analyzing the causes responsible for changes in the wage fund as compared to either the planned wage fund or a wage fund for a prior period, it is also necessary to explain the factors which caused the increase in the average pay. The average pay is affected by changes in the structure of employment (change in the average category grade), which can be studied among other ways by means of the reduction method discussed later, as well as by changes in the amount of remuneration. In particular these changes may be caused by the change in the wage fund structure, especially in such components as premiums for overtime and holiday work, idle time pay, pay differential for low-rate work to high-rate employees, etc. In this connection there arises the need to study the percentage share of each of these components in the total wage fund during various observed periods or in various enterprises where wage fund quota fulfillment is being studied. This matter should be given special attention since the relative growth of the above-mentioned factors indicates a decline in the work organization of the enterprise.

In comparing the actual and planned wage funds it should be borne in mind that the planned fund contains bonuses for fulfilling and overfulfilling quotas. Therefore it is necessary in cases of production quota underfulfillments to deduct such bonuses from the planned wage fund when analyzing the relative wage fund quota fulfillment in order to obtain full comparability between the actual and planned funds and to avoid the danger of obtaining apparently favorable indices of relative

wage fund quota fulfillment when actually the corrected wage fund quota was exceeded.

Summarizing the above considerations on the subject of the methods of analyzing wage fund plan fulfillments, it should be stated that such analysis should be made in conjunction with an analysis of the production quota fulfillment according to value and with due consideration given to shifts in the variety structure and the gross volume of production.

Analysis should be made separately for wage funds of various groups of employees in con unction with an analysis of their average pay.

4. Wage Dynamics

Comparison between the wage fund of a studied period and one for a basic period does not afford a picture of the dynamics of wages, as can be seen from the following example.

For example let us assume that an enterprise employed 80 workers during January and that their wages averaged 800 zlotys monthly. The total wage fund for January amounted therefore to 80x800 = 64,000 zlotys. As a result of mechanization of labor consuming operations the average number of workers decreased to 50 during February (30 workers having transferred to another enterprise). The average wage per worker rose in February to 1,000 zlotys. The total wage fund for February therefore amounted to 50x1,000 = 5,000 zlotys. The index of the dynamics of the wage fund amounts to $\frac{50,000}{64,000} \times 100 = 78.12\%$, but the index of the dynamics of average wage amounts to $\frac{1,000}{800} \times 100 = 125\%$. The dynamics of wages can be characterized only by comparing only the average wage and not the total wage fund for several periods.

The average wage for a given period is obtained by dividing the total wage fund either by the average number of employees for that period or by the time worked by them during that period. This computation can be represented by the equation:

$$S = \frac{x}{T},$$

where S is the average wage,

x is the wage fund, and

T is the average number of employees or time worked by them.

Depending on the kind of wage fund, we distinguish the hourly, daily, or monthly average wage.

The daily average wage is computed by dividing the hourly wage fund by the number of worked man-hours. Since the hourly wage fund contains only those items which are essentially in payment for work performed during the regular day, the average hourly wage represents the pay level for the net work.

Similarly, we compute the daily average wage by dividing the daily wage fund by the number of worked man-days.

The monthly average wage is computed by dividing the monthly wage fund by the average number of workers.

The index of the dynamics of average pay is computed by dividing the average pay level for the period under study by the average pay level for the basic period according to the equation:

$$I_s = \frac{\sum x_1}{T_1} : \frac{\sum x_o}{T_o}$$

or, since X = ST according to:

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$$I_s = \frac{\sum S_1 T_1}{T_1} \div \frac{\sum S_o T_o}{T_o}$$

sub 1 indicating the period under study, and sub o indicating the basic period.

The comparison of the hourly, daily, and monthly average pay dynamics indices shows the progress made by the enterprise in the worktime utilization. If the index of the dynamics of the average hourly wage exceeds that of the average daily wage it means that work time in the enterprise has improved by comparison with the basic period and that the organization of work in it has improved. Since the average daily wage also included pay for hours during the day on which work was not performed, the lower index of the dynamics of the average daily wage compared to that for the hourly wage indicates lesser expenditures for work not performed during the period under study by comparison with the basic period. Similar conclusions are reached when the index of the dynamics of the average hourly wage exceeds that of the average monthly wage.

The equation given above for computing the index of the dynamics of the average wage pertains to the dynamics of a situation with a variable structure. The size of the index however is affected not only by the changes in the level of average pay but also by changes in the structure of the workers' occupations in the period under study from that during the basic period.

In the example given below the actual individual earnings of specific groups of workers were higher during February than during January whereas the average wage of all workers fell below that one for January. The apparent decrease of the average wage level was due to changes in the structure of the phenomenon under study. The portion of the highest paid

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mechanics fell from $\frac{100}{280} \times 100 = 35.71\%$ to $\frac{30}{280} \times 100 = 10.71\%$ whereas the portion of the lowest paid smiths increased in the total number of workers from $\frac{80}{280} x100 = 28.57\%$ to $\frac{150}{280} x100 = 53.57\%$.

Example:

Workers' Groups by occupation	Number of Workers January	February	Wage Fund January	February	Average Wage January	February	Dynamics index in % $\frac{\text{Col 7x100}}{\text{Col 6}}$
Mechanics	100	30	150,000	54,000	1,500	1,800	120
Plumbers	100	100	100,000	120,000	1,000	1,200	120
Smiths	80	150	64,000	135,000	800	900	112.5
Total	280	280	314,000	309,000	1,121.43	1,103.57	98.4

It is therefore necessary to distinguish between the index of the average individual earnings from the index of average wage. The level of the average individual earnings describes the magnitude of the actual average earnings of the worker whereas the level of average wage describes both the average remuneration for worktime as well as the structure of the wage fund with respect to the portions of the various groups of workers who differ in their individual earnings levels. The index of the dynamics of earnings equals the index of the dynamics of the average wage only when it concerns a uniform classification grade of workers. Otherwise these indices vary.

In order to eliminate the effect of changes in the occupation structure on the index of the dynamics of average wage or, in order to obtain a mean index of the dynamics of the average individual earnings, it is necessary to compute the aggregate index at constant structure according to the equation

$$I_S = \frac{\sum S_1T_1}{\sum S_oT_1}.$$

In our example the index of dynamics of the average wage at constant structure amounts to

$$\frac{309,000}{(1,500x30)+(1,000x100)+(800x150)} \times 100 = \frac{309,000}{45,000+100,000+120,000} \times 100 =$$

$$\frac{309,000}{265,000} \times 100 = 116.8\%.$$

Because the magnitude of the index of the dynamics of the average wage at variable structure is affected both by the change in the average individual earnings and the change in structure of occupations, it is possible to compute the effect of the structure change on this index by dividing it by the mean index of average individual earnings. In our example this effect amounts to

$$98.4\% \div 116.8\% = 84.24\%.$$

The mean index of the dynamics of average wage at constant structure can also be computed by means of the arithmetic mean of the weighted index at constant structure according to the equation

$$I = \frac{\sum \frac{S_1}{S_o} \times S_oT_1}{\sum S_oT_1}.$$

In our example the arithmetic mean index of the dynamics of the average wage at constant structure equals

$$\frac{(120x45,000)+(120x100,000)+(112.5x120,000)}{45,000+100,000+120,000} = \frac{30,900,000}{265,000} = 116.8\%,$$

in other words, identical with the result obtained for the aggregate index at constant structure.

In national economic plans and in statistical reporting the indices of the dynamics of the average wage are computed as indices with variable

structure. These indices indicate the increase in the level of the average pay which results from both the increase in remuneration and the increase in the average category grading of the workers ensuing their increased occupational skill.

The indices of the dynamics of average wage at constant structure (aggregate or weighted arithmetic mean) are computed when the necessity arises to study the dynamics of remuneration for work while eliminating the effect of changes in the structure of the grading of the workers. Similar computations can be made by means of the so-called reduction method, or by the running of an actual average remuneration to the wage scale of the first category grade by means of the average coefficient of grading.

For example let us assume that in January the average remuneration of a worker for one man-hour of work amounted to 4.50 zlotys and that the average grading coefficient was 1.8. In February the average renumeration of a worker for one man-hour of work was 6.00 zlotys with the average grading coefficient rising simultaneously to 2.4. Since the grading coefficient defines how many times the given remuneration is higher than the wage scale of grade I category, it is necessary, in order to reduce the actual average pay of the worker to the scale of grade I category, to divide the actual average pay of the worker by the average grading coefficient. On the basis of the data given above we can compute that the wage scale of grade I category was:

in January $4.50 \div 1.8 = 2.50$ zlotys, and

in February $6.00 \div 2.4 = 2.50$ zlotys.

We therefore conclude that the level of pay in February did not change by comparison with January and that the growth in the average remuneration of a worker per man-hour by 33% ($\frac{6.00}{4.50} \times 100 = 133\%$) was

exclusively the result of changes in the structure of employment and in the raising of the grades of the workers as reflected in the growth of the average grading coefficient from 1.8 to 2.4 or by the very same 33% ($\frac{2.4}{1.8}$x100 = 133%).

One should emphasize the fact that in studies employing the reduction method one should deduct from the wage fund those components which do not enter into the wage scale and do not change proportionally with the grading coefficient.

The reduction method can be applied to a very limited extent. The average grading coefficient can be computed only in relation to workers covered by the same scale of wages and therefore the study of the dynamics of the average wage by means of the reduction method can be used only in relation to workers covered by the same scale of wages.

In analyzing the dynamics of wages on the basis of the dynamics of the average wage it is necessary to take into consideration the phenomenon of dispersion, or the scattering of the differences between the pays of specific workers from the average. As is known, there may be considerable differences for the same average wage in the margin of the individual pays. If for example in one enterprise the wages amounted to 800, 1,000, and 1,200, in the second to 200, 1,000, and 1,800, and in the third to 200, 400, and 2,400 zlotys, the average wage in each of these enterprises amounted to 1,000 zlotys (800+1,000+1,200÷3, 200+1,000+1,800÷3, 200+400+2,400÷3) despite the wide disparity in the margin between the individual wages and in the degree of deviation of the individual pay from the average in each enterprise. In this connection it is necessary in analyzing the dynamics of the average pay to study also the dynamics of the coefficient of percentage deviation from the standard (mean).

The phenomenon of wage dispersion can also be scanned to a certain degree from the grouping of the average pays according to their size. In statistical reporting, the study of earnings by classes and by division into basic subgroups of workers was conducted in 1953 on the basis of a report form on the model of 2/VII.

MODEL 2/VII. EARNINGS

Serial No	Gross Earnings in March 1953 in zlotys	Laborers: Number of workers	Laborers: Gross pay in zlotys	Engineering and Technical workers: Number of workers	Engineering and Technical workers: Gross pay in zlotys	Administrative and Office workers: Number of workers	Administrative and Office workers: Gross pay in zlotys	Other Workers: Number of workers	Other Workers: Gross pay in zlotys
1	2	3	4	5	6	7	8	9	10
1	to 400 inclusive								
2	over 400 to 600 same								
3	over 600 to 800 same								
4	over 800 to 1,000 same								
5	over 1,000 to 1,400 same								
6	over 1,400 to 1,800 same								
7	over 1,800 to 2,200 same								
8	over 2,200 to 2,600 same								
9	over 2,600								
10	Total (items 1-9)								

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Of particular importance is the study of differentiation in earnings by sex and by age in capitalist countries.

In the Poland of large landowners and capitalists the average earnings of female workers were considerably lower than those of male workers and this factor explains, among other things, the large scale employment of women in some branches of industry. Table 1/VII shows the earnings of women as compared with those of men in 1934.

TABLE 1/VII

Kind of Manufacture	Average hourly earnings of women in zlotys	Hourly earnings of women in percentage ratio to those of men	Women per 100 employees
[1]	[2]	[3]	[4]
Total manufacturing industry	0.50	70	33
Including:			
Match factories	0.63	68	63
Spinning and weaving	0.56	75	55
Machine industry	0.55	59	2
Machined footwear factories	0.49	58	43
Printing plants	0.47	35	32
Clothing industry	0.40	57	71
Bakeries	0.35	41	14
Cement works	0.32	42	5
Sugar mills	0.27	47	6
Glass works	0.24	45	22
Saw mills	0.20	57	6

a. Excluding women employed seasonally during season.

Source: Statystyka pracy, Rocznik XIV, No 1, 1936, Warsaw, page 26.

VIII. STATISTICS OF DURABLE MEANS

J. Kantor

1. The General Concept of the Statistics of Durable Means

Means of performance are divided, as is known, into means of labor and objects of labor.

Means of labor participate in the production process during a long period of time, consuming themselves gradually, and transfer the value which lies within them to the produced articles. Means of labor do not enter into the matter which they helped to produce. They merely transfer to it that portion of their value which was used up in its production.

Means of labor include, first of all, the durable means such as production machines, technical equipment, means of transportation, etc. They also include buildings and special structures which, despite the fact that they do not directly participate in the production process, are essential to it.

"Besides the objects," says Marx, "which work uses to act on the objects of labor, thereby becoming the carriers of this activity, the process of work includes among its means, taken in the broader sense of the word, all object conditions which are needed to make the process possible. They are not directly a part of it, but without them the process cannot take place at all or cannot take place efficiently" (Marx, K., Kapital, Vol I, 1951, Ksiazka i Wiedza, page 191).

Means of labor are not only those objects which directly or indirectly participate in the production process. Regarding that, "whether the given utilitarian value will appear in the raw material, in the means of labor, or in the product depends completely and exclusively on its defined function

in the work process, on the part which it plays in it, and these definitions changealong with changes in that part" (Ibid., page 193).

One does not include in the durable means for example finishing machine produced by the industrial plant if it is earmarked for sale, since it does not participate in the production process of the plant, but this same machine if installed in the plant and used in the production process is included in the durable means.

Similarly buildings and facilities of industrial plants which were completed but not as yet turned to use are not included in the durable means. They constitute a product of the construction enterprises just as the finishing machine produced in the industrial enterprise constitutes a product of the machine industry.

The listing of the product as a durable means is decided only and exclusively by its participation in the production process.

Not all means of work however which serve to produce are considered durable means. One of the properties characterizing durable means is the relatively long period in which it serves in the industrial process. Neither are means of small value considered durable, even though their duration may be long. To this type of means of work belong some tools, such as drills, cutters, saws, files, chisels, measuring instruments, etc. The inclusion of these and similar items among the durable means would considerably complicate the records of durable means, placing them in line with buildings, machines, technical equipment, etc.

In planning practice, means of labor not exceeding 300 zlotys in value or which are used up in the production process within a year are not included among durable means. They are included in the lesser value and short term inventories (see chapter on "Statistics of Material Supplies").

2. Classification of Durable Means

Durable means of industrial plants consist of a great many means and tools of production differing in purpose, length of use, etc.

This variety of durable means necessitates their classification into defined groups and categories. Criteria for the division include production and technological purposes of their use, degree of participation in the industrial process, durability of function, etc.

By use designation durable means in an industrial enterprise are divided into 2 groups, (1) industrial durable means and (2) nonindustrial durable means.

To the first group belong all means of (industrial) production which serve the activity of the industrial plant in the fields of (a) production, (b) general administration, (c) storing, and (d) selling.

To the second group belong durable means associated with (a) social activity, (b) housing management, (c) farming management, and (d) other nonindustrial activity (divisions of workers' supplies).

The separation of nonindustrial durable means into a separate group is practically and economically advantageous in industry, since consumption of nonindustrial means does not increase the overall costs of production in the industrial plant.

Industrial durable means are further divided according to their production and technical designation depending upon the concrete functions which they fulfill in the production process into the following groups: (a) buildings, (b) special structures and ground facilities, (c) power producing and driving machines and equipment, (d) transmitting equipment, (e) production machines and apparatus, (f) means of transportation, (g) production instruments and tools, and (h) management and office furniture and fixtures.

In the "buildings" group are included buildings and all structures which house the production process, basic as well as auxiliary and by-production. Also included here are buildings serving the production process indirectly such as administrative and management buildings, warehouses, fire and industrial guardhouses, supervisory buildings, etc. Buildings include all sheds and fences.

In the "special structures and ground facilities" group are included structures of a production character (oil wells, drill towers, mine shafts, mine galleries, etc) transportation structures (bridges, railway tracks, roads, viaducts, etc), hydrotechnical structures (dams, sluice gates, canals, dikes, pressure towers), structures for communications (overhead electric network lines, cables), as well as facilities of sewerage, heating, and chimneys on separate foundations.

In the "power producing and driving machines and equipment" group are included, first of all, power engines (steam, combustion, turbines, locomobiles, transformators, generators, electric motors, etc).

In the "transmitting equipment" group is included equipment serving to transmit mechanical and electrical power (distributors, transmitters) gas, compressed air, and steam pipes.

The "production machines and apparatus" group is not uniform in nature. It includes work equipment by means of which the worker acts directly on the object of production. According to the production process the technical equipment group is divided into the following.

1. Mechanical equipment (processing machines of all kinds, mining cutters, picks, spinning machines, printing machines, paper machines, packing machines, pouring machines, sewing machines, etc).

2. Equipment for thermal processing of materials (blast furnaces, open hearths, casting furnaces, electric furnaces, baths).

3. Equipment for chemical processing of materials (equipment for chemical reactions, etc).

In the "means of transportation" group are included all means of transportation earmarked for the transport of people, goods, and loads of all kinds, such as rolling stock (locomotives, cars, platforms, trolleys, cisterns), marine stock (barks, cutters, steamships, ferrys, boats), automotive stock (passenger cars, trucks, tractors, trailers), wheel stock (draught horses, wagons, coaches, sleds), and aircraft (planes, gliders, dirigibles).

One should note at this point that means of transportation do not include livestock and poultry which are classified separately as "livestock."

The "production instruments and tools" group comprises all measuring devices, laboratory equipment (micrometers, chronometers, microscopes, calorimeters, cutting, crushing, and pressure tools). This group also includes containers considered durable means (for example oxygen tanks).

The last group, "management and office furniture and fixtures" indludes the durable means implied in the name if they are not part of the small value or nondurable inventory (technical library, typewriters, adding machines, duplicating machines, fireproof cabinets and safes, etc).

In establishing the group to which a given object should be included, the basis for its classification should be its fundamental destination, and if, for example one building houses several factory departments

including the workers' hall, the entire building is considered productive since that is its fundamental designation.

Durable means are further divided into (1) owned, (2) installed, (3) active, (4) in reserve or storage, and (5) leased.

Owned durable means include all equipment owned by the plant, regardless of the degree of its usefulness.

Installed durable means include all exploited equipment (including that turned over for capital repairs). Movable equipment (not mounted in a foundation) found in the plant but not in the warehouse is considered installed if it is assembled and ready for use.

All equipment not in use in the warehouse or enroute, equipment not assembled, etc is considered not installed.

Active durable means are pieces of equipment which were used in a given period, regardless of for how long. One should not confuse the concepts "active durable means" with "active part of fixed assets," which includes machinery and technical equipment and which is the opposite of the "passive part of fixed assets" that is buildings, sheds, and special structures.

The group of durable means in reserve comprises all equipment found in the warehouses and earmarked for the replacement of withdrawn durable means.

Leased durable means are classified according to ownership (plants, enterprises, etc) from which they were rented.

Industrial enterprises maintain a uniform card index system for the detailed recording of durable means. The face of the card contains

the inventory number, name of item, location in the plant, date when put in use, original value at fixed prices and at current prices, life expectancy, rate of depreciation, yearly depreciation amount, data on insurance coverage, and data on capital repairs. The back of the card contains data on the inventory value, depreciation value and depreciation reserve fund.

(See Model 1/VIII on page 313)

The above superficial listing shows how complicated is the structure of durable means. There is therefore no wonder that great weight is given to the application of the proper and detailed classification of them since only on the basis of a rationally worked out classification can there be an efficient recording of durable means.

MODEL 1/VIII

0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9

Enterprise -- Plant Subject **Name** of Detailed Listing Symbol **Page** registration No

Inventory No **Name** of object Designation

Day Month **Position**

Year file

Location from position file from date -- department

Date put in use Value in 1938-1939 according to opening inventory

Insurance

Value from 1938-1939 | Yearly rate of depreciation % | Yearly amount of depreciation

zlotys

Degree of use on day of acquisition | estimated life expectancy | normal yearly depreciation rate | yearly depreciation amount | Year | Value of insurance | zlotys

%

Listing of capital repairs

Description of object

Order | Year of repair | Costs

Date | No | Actual | Estimated

3. Structure of Durable Means

The structure of durable means differs in various industrial plants and in various branches of industry. It depends on the kind of industrial process used and on the size of the industrial plant. In large enterprises the share of machinery and equipment in the total durable means value is usually larger. On the other hand in small plants the value portion of buildings and inventory is greater since the concentration of production causes savings in the investment outlays for buildings and structures.

The interrelationship between the various groups of durable means depends further on the technical level of the industrial plant and on the form of the production organization. The higher the technical level of the given enterprise, the larger the share of machinery and equipment in the total structure of durable means.

To study the proportions of the various durable means in industry and in the various branches one uses the index of the durable means structure.

The index of the durable means structure is the percentage relationship of the value of the varying groups to the total value of the durable means.

Table 1/VIII represents an example of the percentage share of durable means in the various branches of industry and contains data regarding the fundamental industry promoting durable means for the heavy industry in the USSR at the end of 1934 (See Sawinskiy, D. W., Kurs promyshlennoi statistiki (Russian edition), 1949, Moscow, page 276).

TABLE 1/VIII

Branch of Industry	Buildings	Structures	Power Installations	Production machines and apparatus	Instruments and tools	Inventory	Transportation
1	2	3	4	5	6	7	8
Total industry	29.7	23.1	8.8	27.6	0.8	2.4	7.6
Creating means of production	27.0	27.2	8.7	26.4	0.8	2.2	7.7
Creating consumer goods	39.1	8.6	9.4	31.7	0.6	3.1	7.6
Power stations	17.6	--	48.5	30.6	1.2	0.8	1.3
Coal industry	16.8	33.2	3.8	23.0	0.3	4.5	13.1
Oil industry	7.5	60.5	4.7	23.6	0.5	0.7	2.5
Metallurgy	21.9	36.9	8.8	20.6	0.4	0.9	10.5
Metals industry	42.5	10.4	5.0	33.7	1.6	2.3	4.5
(Basic) chemical industry	25.1	12.9	8.3	47.5	0.5	1.1	4.6
Textile industry	40.4	4.9	11.2	38.2	0.8	2.4	2.5
Confections industry	54.5	3.0	4.4	27.2	0.3	7.8	2.3
Food industry	38.0	9.5	0.0	26.5	0.6	3.5	12.9

4. Evaluation of Durable Means

Durable means include a variety of objects (means of work) such as buildings, structures, technical installations, means of transportation, etc, which cannot be counted in a unit of measure common to them all. The only measure covering all durable means is their monetary value.

The evaluation of the worth of durable means is necessary not only for the drawing up of yearly inventories of durable means but also for the computation of the depreciation reserve fund. Over and above that the evaluation of durable means in terms of worth gives an ideal of the overall magnitude of durable means and of the dynamics of industrial development.

In the evaluation of durable means, as in the computation of the value of production, the question arises as to what value should be adopted for evaluation purposes. To be considered are (1) full purchase value (initial value), (2) full replacement value, and (3) full final value.

Full purchase value is the sum of the financial outlays actually spent for the acquisition or purchase of the durable means, that is, the actual amount of investment outlay at the prices prevailing when the investment was made. A characteristic trait of the full purchase worth is the fact that it comprises expenditures made at varying times and under varying conditions affecting the worth of some elements of the durable means. The durable means value thus obtained is not conducive to the comparison of their dynamics even within the scope of a group of the same value. Two processing machines alike as to type and size installed in the plant at different periods may for example possess different initial value. The machine installed in the plant in 1950 has an initial value of for example 10,000 zlotys and the same machine installed in 1953 may have

an initial value of 9,000 zlotys.

The full replacement (recreation) value defines the magnitude of the durable means at the period under examination at a value according to its evaluation at that time. In order to obtain the replacement value it is necessary to recompute all durable means at the current prices of the period under study. In other words evaluation at full replacement value defines what amount would have to be expended at the time the statistical study was made, in order to purchase all the durable means on hand.

To use the example given above, the machine installed in 1950 would have to be valued in 1953 at a replacement value of 9,000 zlotys since such an amount would have to be spent in 1953 in order to install a machine of that type and size.

Evaluation of durable means at full replacement value does permit the comparison of their size and dynamics.

If we take in account the tremendous number of objects constituting the aggregate durable means in the various industrial plants it will be easy to realize that reevaluation requires a great deal of work. Since the end of the war reevaluation of all items was done in Poland only once in order to get an idea of the inventory value of all durable means.

The reevaluation of all durable means was not done in a uniform manner and the obtained full replacement value is not too accurate. Lack of realistic data hampers the study of the dynamics of durable means as well as the correct computation of the amount of their consumption.

It is for this reason that Resolution No 896 of the Government Presidium of 10 October 1952 regarding the preparation for a general in-

ventory of durable means in the socialized economy of the Polish People's Republic (Monitor Polski A-88, 1952, position 1372, is of fundamental significance. For the first time a complete listing of the durable property and its evaluation according to the full replacement value will be made. To work out the problems of methods GUS called upon the office of the general government commissioner for general inventories as well as inventory commissions and commissioners within each ministry and central administration.

It is to be expected that for the first time a realistic quantitative status of durable means, its structure, and full replacement value according to actual prices will be established. This will permit the definition of the degree of physical use and the value of consumption of durable means, on the basis of which uniform depreciation norms will be worked out for the various kinds of durable means to correspond with the actual depreciation.

The need to compute the full final value of durable means arises from the fact that the evaluation of durable means according to the full purchase value defines their value at the moment of their acquisition and is expressed in various prices. The evaluation of durable means on the other hand according to the full replacement value is measured in uniform prices of the period under study and defines the magnitude of replacement costs for all durable means.

All durable means are gradually used up during the production process partially transferring their value to the produced articles. For this reason in order to obtain that value of the durable means which has not as yet been transferred to the product, it is necessary to subtract from the full purchase value the amount of consumption (degree of depreciation of durable means).

The value thus computed is defined as the full final value.

5. Capital Repairs

By a capital repair is meant a repair leading to an improved technical efficiency of the durable means which had decreased as a result of consumption or damage. Capital repairs are done in order to prevent the premature retirement of machines or installations through the systematic renewing of the various parts of the item. The question arises to what limits of renewal of the various parts of machines and installations can be considered as capital repair since such repair could reach such dimensions which would lead to the creation of a new machine or installation. The instruction now in force considers as a capital repair repairs costing between 30 and 70% of the original value of the item but never exceeding it over 70%.

Capital repair costs comprise material cost for spare parts and furnishings, payroll expenses, as well as service labor and fees to executive departments for capital repairs.

The capital repair cost of a given item is always entered on the file card of the durable means, whereas the cost of current repairs does not call for adnotation.

Current statistical reporting concerning the course of capital repairs is comprised in the following model.

MODEL 2/VIII

PART I. CAPITAL REPAIRS PLAN FULFILLMENT ACCORDING TO VALUE IN 1,000 ZLOTYS*

Serial No	Itemization	Total Cost of repairs according to yearly plan	Capital Repairs Expenditures from Beginning of Year to end of report month			
			According to prices adopted in the plan		At actual cost or at estimated prices	
			Total	Including for repairs done for agencies outside own ministry	Total	Including for repairs done for agencies outside own ministry
1	2	3	4	5	6	7
1	Total capital repairs					
2	Including for repairs to production machinery and technical installations					
3	Means of transportation					
4	Construction items (excluding residential buildings)					
5	Residential buildings					
6	Land and marine items					
7	Future documentation					

*Carried to one decimal point.

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6. Depreciation of Durable Means

We mentioned before that durable means participate in the production process for a long period of time, using themselves up gradually, and the degree of this consumption depends among other factors on the intensity of their utilization in the production process. The degree of consumption of durable means resulting from their participation in the production process and expressed in monetary units is called depreciation. The depreciation value is included in the overall cost of the product. In this manner the gradual transfer of the value of durable means to the newly produced articles is accomplished.

It should be emphasized that the means of production cannot relay to the created product more than their own original value. "The means of production," writes Marx, "transfer to the new form of the product value only to the extent which they lost in the form of their former useful value. The maximum lost in value which can be encountered in the process of work is limited to that original value with which they entered the process of work, or to the amount of work time necessary to create them. The means of production therefore can never add to the product more of a value than they possess, regardless of the process of work which they serve. No matter how useful the work material, machine, means of production, still, if it only costs 150 pounds sterling or 500 work days, under no circumstances can there be ~~added~~ more than a 150 pounds sterling to the total products produced with its aid. Its value defines not the work process into which it enters as a means of production but as the work process from which it comes out as a product." (Marx, K., Kapital, Vol I, Ksiazka i Wiedza, 1951, page 218).

Depreciation is figured only for active durable means but not for the inactive since the latter do not participate in the production process and they are not responsible for the creation of a new product to which their value might be transferred, even though the inactive durable means are used up too as a result of the action of natural forces.

Depreciation is not set up for durable means held in reserve or stores. On the other hand depreciation is established for those specific durable means items subject to temporary idleness.

Depreciation is not established for used durable means on which the total value has already been depreciated.

Depreciation is set up in order to replace the used up value of durable means and in order to insure outlays for their capital repairs. The magnitude of the depreciation depends on (a) the value of the means adopted as a basis for computation, (b) the percentage of the depreciation rate, and (c) the method for computing depreciation.

As a basis for computing depreciation the full purchase value (initial value) of the durable means is adopted. The depreciation rate depends on the time that the durable means remains useful in the creative process and upon its full purchase (initial cost).

The functioning period of the durable means and the creative process depends upon many factors connected with the nature of the means as well as with the conditions of its use. Durable means for example are used up more quickly at high temperatures, with the application of strong chemical reagents, high pressure, etc. The speed with which a machine is used up depends also upon its construction.

The intensity of their load or the so-called degree of utilization of durable means has a fundamental effect on the degree of their consumption. In the same branch of industry the load on similar means of work can vary and it can change as a result of a change in the operation time of the means of work or as a result of a change in the degree of the utilization of its productive capacity during its operation. In the Soviet Union varying depreciation rates are in effect for machines depending upon the number of shifts in which it operates.

The length of service period of durable means is further affected by capital repairs which, even though they do not create new values, do prolong the service time of durable means.

The magnitude of depreciation is decided by rates expressed in percentages. Depreciation rates are established percentages of the value of the durable means which should be applied in computing depreciation amounts during the year. It is always established as a yearly percentage.

Since depreciation should first of all insure the recreation of the durable means as well as outlays for capital repairs on it, the depreciation rate is established from the full initial cost of the given means with the addition of the cost of capital repairs foreseen for it during the period of its use. In establishing the depreciation rate one also takes into account its liquidation value after its exploitable period has passed.

In our planning and bookkeeping practice the method for computing the depreciation rate is done according to the equation

$$A = \frac{P+R-O}{T},$$

where A is the value of depreciation reserve,

P is the full purchase (initial) cost of the given durable means,

R is the cost of capital repair,

O is the liquidation value of the means after exploitation period, and

T is the exploitation period.

Let us assume that the full initial cost of the durable means amounts to 20,000 zlotys, the life expectancy to 10 years, providing a planned capital repair costing 7,000 zlotys is carried out, the liquidation value after exploitation to 1,000 zlotys. Then the depreciation rate in such a case will amount to

$$A = \frac{20{,}000+7{,}000-1{,}000}{10} = 2{,}600 \text{ zlotys yearly, or a } \frac{2{,}600}{20{,}000} \times 100 =$$

13% yearly (a is the percentage rate of the depreciation). This is the so-called method of uniform depreciation, the simplest and most widely used method. It adopts the principle of covering depreciation in equal rates during the established exploitation period, that is, it assumes the uniform exploitation and the uniform consumption of the durable means.

Means of production are not however uniformly exploited. Some are in use less than 8 hours, some 16 or 24 during the day. The depreciation rate should be subject to a corresponding (but not proportional) lowering or raising.

For mechanized vehicles a method of computing the depreciation rate according to the number of travelled km is generally used. Let us say that an automobile worth 40,000 zlotys with an estimated capital repair expenditure of 15,000 and a liquidation value of 5,000 zlotys will travel 150,000 km. The depreciation per one km ride will be

$$\frac{40{,}000+15{,}000-5{,}000}{150{,}000} = 0.33 \text{ zlotys.}$$

From depreciation figures each plant establishes a special depreciation fund which constitutes a reserve fund in industry intended for the replacement of the durable means either by the purchase or production of new means of work to replace the ones completely consumed or through capital repairs. Part of the depreciation fund is transferred to the Investment Bank towards new investments and part to the Polish National Bank and to a special account for capital repairs.

We know that means of work do not require replacement every time they are used in the production process but participate in it for a long period of time. The depreciation fund accumulated throughout this exploitation period of the means of work could be treated as a fixed reserve. Actually it is not. The yearly depreciation sums earmarked for the recreation of durable means exceeds the value of the durable means retired because of consumption during the year. The excess value remaining after expenditures for reproduction of durable means replacing those retired constitute a complimentary source of the growth of durable means. They constitute thus one of the most important components of the process of broadened reproduction.

7. Dynamics of the Magnitude of Durable Means

Establishing the dynamics of durable means is one of the basic tasks of statistics. For this purpose it is essential to have a full inventory of durable means listed according to a uniform method and classification which would define the actual status of durable means.

In this respect the inventory of durable means to be conducted in the near future, as has been mentioned before, will have a fundamental significance for the basis of computing the dynamics of durable means. Changes occur in the magnitude of durable means in various plants resulting

from the turning over of a means of production to another plant, from the purchase or production and installation of new means, or from means received from another plant.

Over and above that a change in the magnitude of the durable means arises as a result of their physical consumption during its exploitation. Durable means are considered entirely consumed from the moment they prove completely unsatisfactory as a means of work. Besides consumption as a result of exploitation, consumption may also occur as a result of disasters such as fire, floods, etc. Durable means are shown in the inventory at the full initial value since that is how they appear on the books in the account "statutory fund." Statistics adjust for any increase or decrease in the value of durable means with the aid of the so-called coefficient of renewal of durable means and the coefficient of the dwindling of durable means.

The coefficient of renewal of durable means characterizes the ratio of the value of the newly acquired durable means to the total value of durable means at the end of the period.

Let us assume that the value of newly acquired durable means in 1951 amounted to 5 million zlotys, and on 31 December 1951 the total of durable means amounted to 15 million zlotys. The renewal coefficient will be

$$\frac{5,000,000}{15,000,000} \times 100 = 33.3\%.$$

That means that the value of durable means increased during the year by 33.3 percent.

The process of growth of durable means is accompanied also by the process of its dwindling.

The decrease in the value of durable means as a result of dwindling

is established with the aid of the coefficient of the dwindling of durable means which is defined as the ratio of durable means used up and withdrawn from exploitation during the period on the report to the total value of durable means at the beginning of the report period.

Let us assume for example that the value of durable means withdrawn from exploitation because of consumption amounted to 1.5 million zlotys during 1951 and the total value of durable means as of 1 January 1951 amounted to 10 million zlotys.

The coefficient of withdrawal of durable means will amount in this case to $\frac{1,500 \times 100}{10,000} = 15\%$.

In computing the above-mentioned coefficient the question arises which value of durable means should be used here, the initial or the replacement value.

In order to obtain comparability one should apply replacement value or value at fixed prices. In view however of the fact that durable means are listed in the inventory at full initial value, the same value is adopted for the computation of the coefficients.

A model of a durable means inventory appears below

Kinds of durable means	Status at the beginning of report period		Added during report period		Dwindled during report period		Status at the end of report period	
	total	active	total	purchased	Total	Consumed	Total	active

The degree of durable means consumption is characterized by the consumption coefficient. It is the ratio of the sum of depreciation amounts shown in the balance sheet of the enterprise to the full initial value

of the durable means. This coefficient shows what part of the durable means value was transferred to the created products.

Let us assume for example that the full initial value of the durable means of an enterprise according to the balance sheet at the end of the report year amounted to 450 million zlotys and the sum of depreciation for the report year to 23,625,000 zlotys. In this case the consumption coefficient will amount to

$$\frac{23,625,000}{450,000,000} \times 100 = 5.25\%.$$

That means that 5.25% of the durable means value was transferred to the created products.

IX. STATISTICS OF UTILIZATION OF MACHINES AND PRODUCTION INSTALLATIONS

J. Kantor

1. Classification of Working Installations

To arrange summary compilations concerning the quantity of machines and production installations as well as their utilization and productivity it is essential to classify them in accordance with certain criteria for example in accordance with the technological purpose, according to the production process, according to the construction, specialization, etc.

The GUS instructions concerning statistical accounting for industry classifies machines and production installations by 2 basic groups, (a) production machines and (b) auxiliary machines.

The production machine group includes all the machines and production installations which participate in the manufacture of the basic product. For example in the textile industry production machines in the

spinning shop are skewers and in the weaving mill they are the looms.

Auxiliary machines are called machines and production installations which participate with the production machine. For example they prepare raw material for production or they impart to the finished article the final form. In textile industry for example auxiliary machines are machines that prepare the raw material for the spinning mill such as doubling winder, combing, cording, and fleecing machines, etc: machines preparing the yarn for the weaving mill such as winders, warpers, starchers; machines and installations to finish the cloth such as washers, mangles, installations for dyeing, printing, drawing, sizing of fabrics, etc.

Statistical accounting treats separately production and auxiliary machines with constant attendance and without constant attendance.

The subdivision of machinery into production and auxiliary is sufficient only from the point of view of the production plan of a given branch of industry. It gives information concerning the outfitting of individual branches of industry in production installations, but does not yield any information concerning the number of individual kinds of machines and installations.

On the basis of the above subdivision the same machine may be, depending on the branch of industry, either a production or an auxiliary machine for example a processing machine of the same type can be considered either an auxiliary or a production machine (for example in basic divisions of a machine building plant the processing machine will be considered a production machine but in the auxiliary divisions of the same plant it will be considered an auxiliary machine).

We thus see that the task of choosing the method to serve as the basis of the classification is a very important matter. We must take account

above all of the purpose that the classification is to serve. If it is to serve for planning the production of an industrial plant it is enough to use the classification applied so far in the statistical accounting. If on the other hand we want the inventory of the machine and production installations to serve as a basis in the construction of the classification it is necessary to employ the technical purpose of the production machine as a criterion.

According to their technological purpose, machines and installations are divided into 3 groups, (1) machines and installations for mechanical processing, (2) machines and installations for thermal processing, and (3) machines and installations for chemical processing.

Each of these groups is divided into subgroups in accordance with the character of the production activity that it serves, in accordance with the type of material processed, construction and principle of operation of the machine, as well as in accordance with the kind of specialization.

For example according to the projected plan of the Polish normalization committee machine tools for metals were classified into the following groups: machine tools for trimming metal; lathe; drill presses, borers, boring-milling machines; milling machines, saws, and fining machines; longitudinal shapers, transverse shapers, slotting machines, drawing machines, mixers; grinders; specialized and special machine tools for threads and gears; and combined machine tools, units and aggregates, aggregate machine tools, automatic machine tool lines.

The above groups are divided into subgroups. For example the lathe group is divided into the following subgroups: general purpose lathe, specialized, special trade lathe, and special lathe devices.

The subgroups in turn are subdivided into kinds for example the general purpose lathe subgroup is divided into the following kinds: table arbor lathe, operating arbor lathe, production arbor lathe, lead arbor lathe, heavy arbor lathe, faceplate lathe (light), faceplate lathe (heavy), facesplit lathe on beds, turret lathe (light), turret lathe (heavy), multicutter lathe, turret single spindle semiautomatic lathe, multispindle semiautomatic lathe, single spindle fully automatic lathe, and multispindle full automatic lathe.

On the basis of the classification thus worked out it is possible to encompass in the compilation as the machines and working installations in each industrial plant, regardless whether these machines are of the production or of the auxiliary type.

So far there has been no general census of the machiner's and working installations in Poland, nor has there been a statistical accounting concerning the balanee sheet and structure of these installations. At the present time, on the basis of the projected inventory of durable means, about which mention was made in the preceding chapter, it will be possible to set up a complete balance sheet and a structure for production installations and machines.

In the Soviet Union the statistical accounting encompasses the state of the available machinery in accordance with the following scheme.

Change in the machine inventory during the accounting year:

Kinds of Installations	Code No	Status at Beginning of year		Status at End of Year		
		total	installed	total	installed	not installed

(Cf. Sawienskiy, D. W., Kus prommyshlennoi statistiki (Russian edition), 1949, Moscow, page 324.)

The list (inventory) of machines and working installations is necessary not only to prepare a machinery balance sheet, it serves equally as a base for calculating the productive capacity of an industrial plant and of the entire industry.

2. Productive Capacity

The concepts of productive capacity is quite difficult to explain and has not been defined uniquely in Poland. The definition of the productive capacity of machine, installation, or a plant, should define clearly the maximum amount of production that is possible of attainment during a defined unit of time.

The instructions of the state economic planning commission concerning the development of the technical-industrial-financial plan for 1951 states that "the productive capacity of the installations is that capacity of producing a definite amount of production within a definite unit of time" (Instrukcja PKPG [Panstowa Komisja Planowania Gospodavczego] Instructions of the State Economic Planning Commission, No 28, 1950, PWG [Polskie Wydawnictwa Gospodarcze -- Polish State Publishing House], 1950, page 16.

It is thus the maximum quantity of production that the machine or installation can perform per hour, day, month, or year, established on the basis of technical norms.

The productive capacity of an industrial plant is defined on the basis of the following.

(a) Number of installed and usable machines and production installations.

(b) Length of operating time of machines and production installations.

(c) Assortment of the types of articles produced by the machines and production installations.

(d) Progressive norms of machine utilization and production installations as attained by leading workers.

(e) Level of advanced technology.

The productive capacity of production machines and installations or of the industrial plant is computed in physical units proper for the given machine or installation. It may therefore be described in t, kg, cu m, etc (for example the capacity of a coal combine or of a coal mine is computed in t of gotten coal. The productive capacity or blast furnaces is computed in t of poured pig iron, the productive capacity of a sawmill in cu m of sawed lumber, etc).

In computing the productive capacity of a plant it is important to establish the worktime of the installations. In cases of continuous work the calendar time less repair time is used for computations. Where work is interrupted the productive capacity is computed on the basis of the product of the nominal time and the number of shifts.

The definition of the productive capacity of a plant is significant not only for the correct foundation and establishment of the production plant,

which must be based on the actual productive capacity of the plants but also for the establishment of the technical reconstruction of the plant as well as the magnitude and character of the essential investments.

The study of the utilization of the productive capacity of plants, enterprises, and branches of industry is an important task of industrial statistics.

The utilization of the productive capacity of a plant is defined by the degree of utilization of machines and installations expressing the ratio of the amount of production actually completed during a given report period to the amount of production which should have been completed according to established norms.

Statistics should systematically supervise the utilization of the productive capacity of machines and installatioss, bringing to light existing reserves and new productive possibilities.

The magnitude of industrial production depends to a great extent on the degree and manner in which the productive capacity of machines and installations are utilized.

One of the fundamental conditions for better utilization of production installations is such an organization of the production in applying the proper technological process as would enable it to function without idling or interruptions in accordance with the operational chart established for each phase of the production.

Work executed according to a daily or even hourly production chart insures the maximum and most uniform loading of a production installations (with the realistic reservation that the chart refers not to individual production installations but comprises all installations utilized during the entire production cycle).

3. Utilization of Production Installations

Statistics study the utilization of production installations with the aid of the following coefficients of loading of production machines and installations: (a) coefficient of intensive load, (b) coefficient of extensive load, and (c) coefficient of the integral load.

The coefficient of intensive load is a ratio of the actual productivity of the installation to its potential productivity. This coefficient is computed according to the equation

$$W_{int} = \frac{Q_{act}}{Q_{pot}} ,$$

where Q_{act} denotes the actual production and

Q_{pot} denotes the theoretical (potential) production.

Let us assume for example that we have to compute this coefficient for a spinning machine. First of all we must compute its theoretical (potential) productivity according to the equation

$$Q_{pot} = \frac{(W)x(ow/m)x(60x8)}{(s)x(N_p)}$$

where Q_{pot} denotes theoretical (potential) production,

w denotes the number of spindles,

ow/m denotes revolutions of the spindles per minute,

60x8 denotes number of minutes per 8 hours work (8 hours selected),

s denotes the number of twists per one m of yarn, and

N_p denotes the twisted yarn number

If we assume that we have to produce yarn No 6 (the yarn number denotes the number of m per one g of yarn, hence the higher the yarn number the thinner the thread and the more m contained in one g) on a spinning machine of 100 spindles, that the speed of the spindles is 5,200 rpm, the

number of twists 500 per m, and production time 8 hours, the theoretical (potential) productivity will amount to

$$Q_{pot} = \frac{100x5,200x60x8}{500x6} = 83,200 \text{ g} = 83.2 \text{ kg}.$$

Let us assume that the actual production of the spinning machine during 8 hours for No 6 yarn was 49.9 kg. The coefficient of intensive load will be

$$W_{int} = \frac{Q_{act}}{Q_{pot}} = \frac{49.9}{83.2} = 0.6 = 60\%.$$

The coefficient of intensive load of spinning machines varies from 55% to 75% depending upon stoppages resulting from removal and replacement of spools, removing yarn knots, etc.

A model of a report form used by some central administrations of industry for the computation of the coefficient of intensive load for spinning mills is shown in Model 1/IX.

(See Model 1/IX on Page 338)

We can compute the coefficient of the intensive load for an entire weaving mill in a similar manner.

The theoretical production of the weaving mill in 1,000 fillings can be computed according to the following equation:

$$Q_{pot} = \frac{(\sum kr)x(o/m)x(60x8)}{1,000},$$

where Q_{pot} denotes theoretical (potential) production

kr the number of looms of uniform revolution speed,

o/m the average revolutions of the loom per minute, and

60x8 the number of minutes in 8 hours work.

The average number of revolutions is computed as a weighted average.

MODEL 1/IX

Kind and No of Yarn	Operation in spindle-hours		Production					Theoretical productivity in Nos	Productivity coefficient		Productivity per one spindle-hour in g		
			In kg		% fulfillment	In kg No							
	Planned	Fulfilled	Planned	Fulfilled		Planned	Fulfilled		Planned	Fulfilled	Planned	Fulfillment	% Fulfillment
1	2	3	4	5	6	7	8	9	10	11	12	13	14
20	110,000	100,000	19,000	20,000	105.3	380,000	400,000	600,000	63.3	66.6	172	200	116.2
40	200,000	200,000	25,000	30,000	120.0	1,000,000	1,200,000	1,800,000	55.5	66.6	125	150	120.6

Let us assume that the weaving mill has 100 looms, including 50 looms with a speed of a 120 rpm, 25 with a speed of 150, 30 with a speed of 170, and 15 with a speed of a 180 rpm.

The average number of revolutions of all looms will be

$$/m = \frac{(30x120)+(25x150)+(30x170)+(15x180)}{30+25+30+15} = \frac{15,150}{100} = 151.5.$$

The theoretical production of 100 looms during 8 hours work in 1,000 fillings amounts to

$$Q_{pot} = \frac{100x151.5x60x8}{1,000} = 7,272.$$

If we accept the actual production during the same period as amounting to 5,090,000 fillings the coefficient of intensive load for the weaving mill will amount to

$$W_{int} = \frac{5,090}{7,272} \times 100 = 70\%.$$

The coefficient of intensive load reflects all the factors which affect the deviation of the actual from the theoretical production, that is, stoppages due to the exchange of shuttles, tying of torn threads of fillings and warps, quality of warps and fillings, and the skill of the employed weavers.

The coefficient of intensive load of the weaving mill is computed in relation to production expressed in varying units of measure, namely, (1) cloth production expressed in weight, (2) cloth production in rm, (3) width of finished cloth, and (4) density of the cloth by fillings (number of filling threads per one cm).

The mean weight of one sq m of cloth is computed according to the equation

$$S_{wt} = \frac{S_{kg}}{S_m} ,$$

where S_{wt} denotes the mean weight of one sq m of cloth and

S_{kg} the production of cloth by weight (kg or t); the average width of the cloth

$$S_{wdt} = \frac{S_m 2}{S_m}$$

where S_{wdt} denotes the mean width of the cloth and

$S_m 2$ the production of cloth in sq m;

and the mean density of the cloth

$$S_{den} = \frac{S}{S_m}$$

where S_{den} denotes the average density of the cloth,

S the production of cloth in million fillings, and

S_m the production of cloth in rm.

Important factors affecting the growth of the coefficient of intensive load are the starting and operating speeds of the machine. Therefore for example in the production process of the machine industry the role played by the speedy cutting of metals on processing machines is important.

Another important factor is the modernization and improvement of machines and installations.

Every accomplishment contributing to the development of technical progress affects the growth of the coefficient of intensive load. The intensity of the utilization of productive equipment indicates the degree of its saturation with work and of its productivity.

The coefficient of intensive load is applied primarily in those branches of industry in which the given installations serve to produce

articles of one kind, for example, the flour mill, ceramic, textile, etc industries.

However in the majority of cases production installations are used for the production of various kinds of articles. The greatest difficulty in computing the utilization index for such installations lies in the variety of both installations as well as the products produced with their help and the worktime needed for the creation of one unit of production. In connection with this the ratio of the actual utilization time of the installation to the theoretical time was adopted as a common measure for the utilization of productive installations.

The starting magnitude therefore is the calendar work time of the machine or installation. The calendar worktime is the maximum time which could have been worked during the report period. During a 30-day month it would therefore amount to 30 days times 24 hours or 720 hours, and during the year to 365 days times 24 hours, or 8,760 hours.

The calendar time for one machine, for example a processing machine, will be equal to the sum of the hours of all the days of the report period. For several machines it will be equal to the product of the hours of all days of the report period and the number of machines.

Besides the calendar time the so-called disposition time or nominal worktime during which a plant was supposed to operate is also applied in practice. For example in a plant working 2 shifts and only during working days the disposition time during a 25 workday month will amount to 25 days times 8 hours times 2 shifts equals 400 hours. Besides the calendar and the disposition time statistical practice also uses for computation planned time, that is, the time in which according to the plan machines and installations should be worked according to the accepted system of work. Planned

time considers stoppages caused by planned repairs. Planned time is therefore shorter than disposition time.

The index for the utilization of a machine's work time is computed in relation to the calendar, disposition, or planned time according to the basis which we adopt for computation.

The ratio of the actual working time of a machine to the calendar or to the planned time is the coefficient of the extensive load of the machine and is computed according to the equation

$$W_{ext} = \frac{T_{act}}{T_{cal} \text{ (or } T_{pln})}$$

where T_{act} denotes the actual work time of the machine expressed in machine-hours and

T_{cal} denotes the calendar time (or T_{pln} -- planned time) in which the machines were supposed to be worked, expressed in machine-hours,

The coefficient of extensive load therefore characterizes the actual degree of utilization of the worktime of the machine whereas the coefficient of intensive load characterizes the productivity of the machine during its worktime.

Let us assume that a plant having 1,000 usable looms works 3 shifts during a month having 25 workdays. The maximum loom-hours in this plant will amount to

(1,000 looms)x(25days)x(8 hours)x(3 shifts) = 600,000 loom-hours.

Let us assume that not all looms were active in all shifts. In shift I 155,000 loom-hours (800 looms) were worked. In shift II 118,000 loom-hours (600 looms) were worked. In shift III 99,000 loom-hours (500 looms) were worked. The total worked was 372,000 loom-hours.

The coefficient of extensive loading of installations in this case will amount to

$$\frac{372,000}{600,000} \times 100 = 62\%.$$

For a model concerning the utilization of machine worktime see Model 2/IX.

(See Model 2/IX on Page 344)

Over and above the coefficients of intensive and extensive load in many instances the coefficient of total load or the coefficient of integral load is applied.

It is the product of the intensive and extensive load coefficients, in other words the product of the coefficients of utilizing production installations with respect to productivity and work time. It is a synthetic index characterizing the productivity of installations. Its equation is $W_{integ} = (W_{ext}) \times (W_{int})$.

Over and above that, current statistics study in detail the causes of stoppage machine-hours. The most typical causes of stoppage are repairs due to accidents, power failure, lack of staff, lack of supplies, etc. Classification of stoppage causes is of great value in analyzing the conditions for utilization of installations which should reveal the organizational and technical reasons causing stoppages and the ensuing lowered coefficient of utilizing installations with regard to worktime.

The list of stoppage causes in model 3/IX is by no means exhaustive. Only the basic causes were taken into account and there is a further series of other causes, for example lack of tools, poor condition of engines or motors, lack or poor condition of means of transportation, interruptions in the regulation or setup of installations or machines, etc.

MODEL 2/IX

NUMBER AND WORKTIME OF MACHINES AND INSTALLATIONS

No	Group Name of Machines and Installations	Number of Machines and Installations					Nominal for 2 shifts	Number of Machine-Hours				
		Total owned	Including installed		Not installed	Not needed		Planned (from production plan)	Actually worked			
			Total	Active					Total	Including in shift		
										I	II	III
1	2	3	4	5	6	7	8	9	10	11	12	13
A	Total production machines											
B	Total auxiliary machines											

Itemize essential basic groups of production machines (having a direct effect on production quota fulfillment.

STOPPAGES OF MACHINES AND INSTALLATIONS

No.	Number of Stoppage Machine-Hours											
	Total (Colums 3-13)	Caused by repairs foreseen in plan				For causes not foreseen in plan						
		Capital	Medium	Preventive, current, and inspections	Accidents and accident repairs	Other not planned repairs	Technological stoppages	Through failures of:				
								Set-up	Power	Supplies	Staff	
1	2	3	4	5	6	7	8	9	10	11	12	13
A												
B												

Itemize essential basic groups of production machines (having a direct effect on production quota fulfillment.

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For this reason some enterprises apply a detailed classification of stoppages by causes which is much wider in scope by comparison with the one used in the described model.

The degree of utilizing production facilities is also defined to a certain extent by the coefficient of machine-hour shifts.

In order to fully utilize productive capacity industrial plants can work 2-3 shifts. The degree of work load of the various shifts varies, that is, not all productive facilities are active during all the shifts.

The task of the coefficient of machine-hour shifts is to show the degree of work load of each shift and the degree of utilization of productive facilities. The coefficient of the machine-hour shift will reflect the degree of actual facility utilization only in the case where the shift with the largest number of used machine-hours utilizes all facilities to their full extent.

We compute the coefficient of shifts for production facilities in the same manner as we do the coefficient of shifts for worked man-hours, that is, the total used machine-hours during all the shifts is divided by the number of machine-hours of that shift in which their greatest number was used.

One can also base the computation of the coefficient of shifts on the number of machines active during the various shifts. The coefficient of machine-shifts computed thus should be close to the coefficient of shifts computed from machine-hours.

Let us return to our example in which we assumed that a weaving mill having 1,000 looms works 3 shifts and that in shift I 800 active looms worked 155,000 loom-hours, in shift II 600 active looms worked 118,000 loom-hours, and in shift III 500 active looms worked 99,000 loom-hours.

The coefficient of shifts according to the number of active looms in the various shifts will amount to:

$$\frac{800+600+500}{800} = \frac{1,900}{800} = 2.38.$$

The coefficient of shifts according to the number of worked loom-hours in the various shifts amounts to

$$\frac{155,000+118,000+99,000}{155,000} = \frac{372,000}{155,000} = 2.40.$$

In view of the fact that not all productive facilities were fully utilized in the various shifts, the machine-hour shifts coefficient does not give the true picture of facility utilization.

For this purpose the so-called exploitation coefficient for productive facilities is computed according to the equation

$$W_{exp} = \frac{m_{act}}{m_{ow}} \times 100,$$

where m_{act} denotes the machines active in the largest shift and

m_{ow} denotes total machines owned.

We stated in the example that the weaving factory owned 1,000 looms but that the greatest number of looms worked (shift I) was only 800. Therefore 200 looms remained in reserve. It is particularly important to compare the number of active machines and facilities with the number of machines owned. Wherever excessive reserves are established it is necessary to determine if they are justified in the production needs of the plant.

In the above case, the exploitation coefficient for the looms amounts to $\frac{800}{1,000} \times 100 = 80\%$.

A characteristic example for the analysis of facility utilization with respect to work time is given by A. M. Dlin (Dlin, A. M., <u>Techniczno-</u>

ekonomiczna analiza produkcji przemyslu budowy maszyn [Technical and Economic Analysis of the Production of the Machine-Building Industry], 1951, PWG, page 107.) in the form of a square diagram.

Diagram

	Not Assembled	Assembled but not active		
			Incomplete shifts	24 hours
			Stoppages during shift	16 hours
			Utilized worktime	8 hours
				0
Quantity of machines	2	4	20	

On the horizontal [sic] line of the square the number of machines according to the inventory was listed as follows: machines not assembled, machines assembled but not active, and active machines.

On the vertical line was measured the worktime of the machines during the 3 shifts. This time is divided into time actually worked, stoppage time during the shift, and time not utilized in the shifts. Lines drawn through the points of measured time give a square corresponding to the coefficient of the extensive utilization of machine worktime.

For the above diagram the following number of machines according to the inventory were used.

Total	26
Not assembled	2

Assembled but not active	4
Active	20

The coefficient of machine exploitation amounts to

$$\frac{20}{26} = 0.77.$$

If we accept the shift coefficient of the machines as amounting to 2.4 or to 80% of the calendar time and the stoppages as amounting to 21%, then the actual utilization machine work time was (100)-(20)-(21) = 59% of the calendar time.

Translating this into hours, we obtain: (a) utilized time 0.59 x 24 = 14.16 hours, (b) stoppage time 0.21x24 = 5.04 hours, and (c) time not utilized in shifts 0.20x24 = 4.8 hours.

The general coefficient of exploitation and work time utilization of the machines will amount to 0.77x0.59 = 0.45.

It is marked on the diagram in the enclosed area.

Both the worktime utilization of productive facilities as well as the growth of the shifts coefficient and decreasing of stoppages are limited by time. During a year production facilities cannot be utilized more than 365 days or 8,760 hours. There is therefore a physical time limitation for facility utilization.

On the other hand the utilization of the productive capacity of installations and the increase of production associated with it fundamentally have no limit. With the development of technological progress, the introduction of new facilities, the increased skill of laborers, and the perfection of work organization increases the degree of intensity of utilization of productive installations.

One of the characteristic special coefficients in the metallurgical industry is the so-called index of blast furnace utilization.

This index is computed by dividing the number of nominal so-called cu m hours by the amount of poured pig iron, and the various kinds of pig iron are computed as open hearth pig iron.

In order to compute the cu m hours, the so-called volume coefficient is used in which the internal capacity in cu m of the blast furnace is accepted as its productivity per unit time and the unit of time is accepted as 24 hours. In other words it is the product of the blast furnace volume and the number of its work hours.

The calendar time of the blast furnace in a given report period is divided into the pouring time and the stoppage time while hot (the time interval between the pouring of the pig iron and the reloading) and while cold (the last happens only during capital repairs).

The nominal (disposition) worktime of the blast furnace is the actual worktime (pouring) and the stoppage time while hot. The product of the nominal time and the internal volume of the blast furnace gives the number of the nominal cu m hours.

The coefficient of blast furnace utilization is computed from the equation

$$W_{bf} = \frac{Q}{q_p x24}$$

where W_{bf} denotes the coefficient of blast furnace utilization,

Q denotes the number of nominal cu m hours (cu m/h),

q_p denotes the production of pig iron computed as open hearth pig iron, and

24 denotes the hours during the day.

Let us assume that the nominal number of cu m hours during the given report period amounted to 10,387 in 1,000 cu m/h and that the production computed as open hearth pig iron for the period was 350,000 t. Then the coefficient of blast furnace utilization will be $\frac{10,387,000}{350,000x24} = 1.24$ cu m of furnace volume per one t of production during one day.

We mentioned before that the volume coefficient of the blast furnace (0) is obtained as the product of the volume and the work hours of the furnace, that is to say

$$0 = \frac{(V_1 \times T_h)}{I_p},$$

where V_1 denotes the useful volume of all active furnaces (average for the period),

T_h denotes the actual number of furnace work hours, and

I_p denotes the number of active furnaces.

The general equation for the coefficient of blast furnace utilization appears as

$$W_{bf} = \frac{(V_1 x T_h) \div I_p}{q_p x 24}.$$

Substituting figures for the symbols in the above equation we obtain $W_{bf} = \frac{(5,940x31,476) \div 18}{350,000x24} = 1.23$, where 5,940 describes the used volume of the active furnaces (mean for the period), 31,476 denotes the number of furnace work hours, and 18 denotes the number of active furnaces.

The coefficient of utilization of open hearth furnaces in a steel works is similarly computed with the adoption of the number of t of steel per sq m workday.

The difference in the coefficients of utilization of the open hearth and blast furnace lies in the fact that for the blast furnace the coefficient of volume is adopted whereas for the open hearth the coefficient of area is used, that is, the product of used surface area of the open hearth shaft and its workhours.

The coefficient of blast furnace utilization defines the furnace volume needed to produce one t of pig iron during a day, and that for the open hearth that of the steel production falling on one sq m of shaft surface during the day. The equation for computing the coefficient of the open hearth utilization is

$$W_{mart} = \frac{q_{st} x 24}{G},$$

where W_{mart} denotes the coefficient of the open hearth furnace utilization,

q_{st} denotes the steel production in the report period, and

B denotes the number of nominal sq m hours.

XIII. STATISTICS OF OVERALL COSTS

J. Kantor

1. General Information Regarding the Statistics of Overall Costs

The term overall costs of an industrial enterprise is understood by us to mean the sum of monetary expenditures in the manufactured product within a definite period. Overall costs include expenditures for raw materials and other materials, fuel, purchased electricity, amortization of capital goods, wages, etc.

Overall production cost is a basic index of rational management and profitability of an industrial enterprise. It reflects all the processes related with the manufacture of the product namely the utilization of capital goods and rotating means, the struggle for product quality and for the reduction of rejects, as well as the proper administration of nonproductive expenditures. Proper compilation and analysis of the statistical material concerning overall costs makes it possible to uncover and eventually eliminate shortcomings in the basic economic and financial production indices.

The tasks of industrial statistics are concentrated in the calculation of the percentage of reduction of overall costs, control of performance of the plan for reduction of overall costs, examination of the structure of overall costs, as well as the calculation of the indices of the rate of change of the costs.

Overall costs are reduced by reducing the expenditures in materials and in labor required to produce a unit product and in the broader sense by reducing the overall expenditures of carried-over and live labor.

Reduction of overall costs by reducing the material expenditures (economy and consumption of raw materials, auxiliary materials, fuel, and electricity) is of exceedingly great importance because their share in the overall costs in the production of an enterprise amounts to approximately 73% in heavy and medium industry. The share of materials costs in overall costs of production ranges in a different manner in various branches of the industry depending on the structure of the expenditures typical for the given branch. For example the share of wages in the mining industry (coal mining, petroleum, iron-ore and nonferrous metal mining, stone quarrying, etc) reach almost 70%, while in the food industry in some cases it reaches barely 10%. The opposite holds for the share of material expenditures in those industries. In the mining industry they amount to 25%,

while in the food stuff industry up to 90% of the overall costs of production.

A source of reduction in overall costs is as much economy in materials as economy in live labor.

This economy can be obtained through the following (1) reduction in production losses in the form of raw material scrap and defective production, (2) replacement of materials in short supply by those that are more plentiful, without reducing the quality of the product, (3) improvement in the quality of the raw material and semifinished materials (the use of unsuitable grades or unsuitable dimensions of materials for production leads to excessive consumption of materials), (4) reuse of the scrap raw material, (5) improvement and normalization of the construction of the produced articles, and (6) increased labor productivity.

The basic index of suitable management of materials are the technical norms of material consumption.

A reduction in overall production costs chargeable to raw materials and semifinished materials consumed in the production is obtained by reducing their consumption per unit production for example reduction in the lumber used for suites of furniture, reduction in electricity used in the production of a ton of carbide, reduction in the coal consumed for the generation of one kwh of electricity, greater yield of sugar per quintal of sugar beets, greater yield of oil per quintal of rapeseed, etc.

Reduction in the consumption of raw and semifinished materials is of great significance not only because it leads to a reduction in overall costs but also because it contributes to an increase production based on not increasing the quantity of raw materials, and this is of

particular import in the consumption of imported materials or those in short supply.

Another index affecting the reduction in overall costs is an increase in labor productivity, meaning a reduction in expenditure of live labor on the performance of unit production. This is reflected in the level and structure of production cost in the form of reduced expenditures for wages per unit production, with simultaneous increase in earnings based on the increase of labor productivity. Let us illustrate this with an example. Assume that a worker earning 30 zlotys a day has produced 10 units, meaning that the cost of live labor expenditure per unit production was 3 zlotys. Assume furthermore that the workers productivity has risen, resulting in 12 production units, and his earnings rose to 33.60 zlotys. In this example the labor consumed per unit production amounts to $\frac{33.60}{12}$ = 2.80, that is, the labor cost per unit production was reduced by 6.7%.

$$\frac{2.80}{3.00} \times 100 = 39.3\%.$$

As follows from the above example, the greater the labor productivity, the lower in principle are the production costs and therefore also the overall cost of the particular industrial plant.

A third source of reduction of production overall costs of industrial production is an increase in the utilization of the production facilities.

Durable means (production facilities) that participate in the production process for a long period of time are gradually used up, whereby the degree of utilization depends, among other things, on the intensity at which they are used in the production process. Expressed in monetary units, the consumption of durable means due to their participation in the production process, called amortization, is chargeable to production overall costs.

An increase in the degree of utilization of durable means increases the quantity of production per unit of technical outfitting, thereby influencing the reduction of the percentage share of amortization in the overall production costs.

The amortization chargeable per unit production is reduced by increasing the productivity of the installation by way of employing the most effective technological methods and by introducing norms that are based on the accomplishment of leading workers.

In addition to the above-mentioned types of expenditures, overall production costs also include costs related to the administration and management of the plant as well as so-called nonproductive costs, such as government fines, damages, interest on loans, costs of service moving, etc.

One of the sources of reduction of overall production costs of industrial production is a reduction in administrative expenditures, the struggle against administrative overhead.

To sum up, we can say that sources of reduction of overall costs of industrial production are reductions in the consumption of raw materials, semifinished materials, and fuel per unit production, increases in labor productivity, increases in the degree of utilization of production installations, and reductions in administrative expenditures.

The overall cost of industrial production is therefore dependent on the organization of production and on the technical level. The level of overall costs is as a rule lower in a plant with modern technology than in a plant that is backward with respect to technology and organization.

2. Analysis of the Structure of Overall Costs and Percentage of Cost Reduction

Structure of Overall Costs

Proceeding now to the study of overall costs of a plant we must know their structure, that is, the individual component parts. These are covered from the financial point of view in 2 classifications in accordance with (a) the particular individual basic products and (b) individual basic departments.

Since not all costs can be directly chargeable to individual products, costs are divided into (1) direct and (2) indirect.

Direct costs include those that can be charged to a particular manufactured product at the instant that they are incurred, on the basis of primary documents (for example, labor cards or warehouse receipts).

Such costs are principally (1) expenditures for basic materials, (2) expenditures for auxiliary materials, (3) direct wages, (4) losses incurred by spoilage, (5) special costs, (6) expenditures for technical fuel, and (7) expenditures for electricity and steam purchased for technological purposes.

Indirect costs include (1) departmental costs and (2) general factory costs.

As we see, direct costs include charges directly related to the performance of a given product, that is, sums expended for: (a) raw materials and basic materials directly entering into the stock of manufactured products;

(b) auxiliary materials, which participate in the manufacturing process of a given product; (c) fuel for technological purposes (included here is solid fuel as well as liquid and gas fuel); fuel for administrative purposes (heating) is included in the general expenses; (d) electricity and purchases steam for technological purpose as well as power for traffic needs (electricity used to illuminate offices, platforms, and warehouses is included in the general factory expenses; and (e) wages to workers, including only the wages to productive workers jointly with all the surcharges as well as social security for the workers.

Indirect costs are related to the overall activity of the productive enterprise and have no direct connection with the production. They can be included in the value of the product only in an indirect manner on the basis of an accounting system (for example proportional to the labor expended by the workers directly engaged in the production).

General departmental costs include wages, together with all surcharges and social security paid to the departmental personnel, to the departmental workers such as furnace attendants, sweepers, and other auxiliary workers who service the departmental buildings. These also include costs for indirect materials, fuel or power, amortization of production installations, and the cost of consumption of expendable materials, and costs for current repairs.

General factory costs include wages together with surcharges paid to the administrative personnel under the jurisdiction of the enterprise administration, expenditures for service delegations, expenditures for office costs, for maintenance and repair of buildings, inventory of the enterprise offices, for maintenance and amortization of the real estate, for maintenace of the warehouses serving to store the raw materials as well as supplies and the finished products, for premiums paid to rationalizers

and inventors, and for training of workers, as well as nonproductive expenditures such as fines, penalties, and losses due to spoilage of materials and defective products.

Indirect costs are allotted proportionally either to the direct wages or to the weight of the products, or else to the time required for production of the finished product, etc.

In addition to the above division, overall costs are subdivided into variable and fixed costs. Variable costs are directly dependent on the size of the production and are proportional to it. Variable costs are subject to change depending on the size of production. The greater the production, the greater is the proportion of the sum of the variable cost, and conversely, the variable costs diminish with diminishing production.

Fixed costs include, for example, administrative costs, such as the wage fund for the general administrative workers, cost of service delegations, costs related to heating and illumination of the offices, etc.

Overall costs are calculated on a production unit basis and are thus charged to the entire production of a given article.

Assume that the enterprise has produced 1,000 units of article A. The per unit production cost as well as the total production cost are given by way of example in Table 1/XIII.

TABLE 1/XIII

Calculated Charges	Per Unit Production Plan	Fulfillment in zlotys	For finished production
1. Raw and other basic materials	25.20	23.50	23,500
2. Auxiliary materials minus scrap	8.60	8.10	8,100
of value	0.68	0.58	580
3. Direct wages	28.15	24.30	24,300
4. Other direct costs	6.35	8.20	8,200
5. Departmental costs	30.06	29.98	29,980
6. Overall factory costs	25.55	25.47	25,470
7. Total production costs	123.23	118.97	118,970
8. Sales costs	6.71	6.35	6,350
9. Total cost of overall production	129.94	125.32	125,320
10. Turnover tax	36.20	36.20	36,200
11. Result: profit (+) loss (-)	+0.50	+1.10	+1,100
12. Selling price	166.64	162.62	162,620

On the basis of the above example we see that the enterprise has effected economies in all kinds of calculated charges with the exception of "other direct costs," thanks to which the overall cost of product A was reduced by 2.42%.

Subdivision of overall cost into individual calculation items is of importance because it answers the question as to on what and to what extent the enterprise has used up the monetary means in connection with the creation of a given product. Comparing the actual overall cost structure with that planned during the period under consideration as well as with the actual cost incurred during the same period of the prior year, it is also

possible to determine to what extent the economy gained affected the fulfillment or overfulfillment of the plan for reduction of overall costs.

The current accounting incorporates calculation of overall costs in accordance with Model 1/XIII.

MODEL 1/XIII

IN ZLOTYS AND GROSZY

No	Calculation items	Unit of measure	Plan for 1954			Fulfillment in 1954							
						During report quarter			From beginning of the year to the end of report quarter			For actual production from beginning of year to end of report quarter	
						Per unit of production							
			Quantity	Price	Amount	Quantity	Price	Amount	Quantity	Price	Amount	Quantity	Amount
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Direct (basic) costs total												
2													
3													
4													
5													
6													
7	Departmental costs	x	x	x		x	x		x	x		x	
8	For own consumption					x							
9	General factory costs*	x	x	x		x	x		x	x		x	
10	Loss on rejects	x	x	x		x	x		x	x		x	
11	Decreasing of costs					x							
12	Total cost of production (Pos. 1÷7-8+9+10-11)	x	x	x		x	x		x	x		x	

1	2	3	4	5	6	7	8	9	10	11	12	13	14
13	Selling expense	x	x	x		x	x		x	x		x	
14	Overall cost	x	x	x		x	x		x	x		x	
15	Turnover tax	x	x	x		x	x		x	x		x	
16	Result: profit (+): loss (-)	x	x	x		x	x		x	x		x	
17	Selling price	x	x	x		x	x		x	x		x	
	*Nonproductive expenses constitute ---% of total factory cost	x	x	x		x	x		x	x		x	

Unit cost of production for 1953, (a) actual... (b) corrected...

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Comparable and Non-Comparable Production

The extent of reduction in overall costs can be specified only in relation to those articles of which the overall costs can be compared with the overall cost of similar articles produced during the basic period, that is, relative to the so-called comparable production.

In the calculation of the economies resulting from reduction in overall costs of comparable production, one compares 2 groups of production expenditures, actual expenditures incurred in the comparable production during the accounting period and expenditures that should have been incurred for the same comparable production in the accounting period in accordance with the per unit cost for a basic period.

According to the accepted definition, comparable production should include all kinds of production performed during the current and past year, identical in both these periods with respect to assortment, standard (norm), and technical specifications.

Comparable production also includes products which experienced a change in name only, without changing the production process or standard, as well as production in which the quality has been improved, in which the technological process has been modified, or in which partial changes have been made in the composition of the raw and semifinished materials used in its production (for example, substitute materials) under condition that both the standard as well as the product were not fundamentally changed.

It does not matter from this point of view from what raw material or with which technological process this product was made, provided the replacement of the raw material or the technological process is not accompanied by a deterioration in the quality of the product.

When production is classified as comparable it is of basic importance to determine whether the new product produced in the past (basic) year was made on a factory scale, or whether the production was of the experimental character. Production of new articles not produced on a factory scale is not classified as comparable, for their production costs are not accurately known (costs of experimental products are fundamentally always higher than costs of products made on a factory scale).

The proper classification of products as belonging to a comparable or noncomparable production is of great significance in the analysis of the performance of the plan for reduction of overall costs.

The lack of specific definitions of what production should be classified as comparable may lead to a narrowing of its scope and may result in the data on the reduction of overall costs being unrealistic, and the enterprise will not know the results of its struggle towards reduction of overall costs.

In accordance with the instruction, one charges to the comparable commodity production of the enterprise the value of all the finished articles and services. An article or service can be charged to non-comparable marketable production only exclusively upon approval of the supervisory authority.

An example of the compilation of overall costs of comparable production is given in Table 2/XIII.

TABLE 2/XIII

No	Position Name of expenditures	Comparable Commodity production of current period according to overall costs in 1,000 zlotys		Savings or overrun in relation to overall costs of the prior period	Change in Overall Costs during the current period in %	
		Prior period	Current period		For the given expenditure	In relation to total
1	2	3	4	5	6	7
1	Raw and basic material	7,350	6,810	-540	-7.3	-57.2
2	Auxiliary materials	1,575	1,425	-150	-9.5	-15.9
3	Fuel	200	180	- 20	-10.0	- 2.1
4	Electric power	630	580	- 50	- 7.9	- 5.3
5	Productive labor cost	3,000	3,150	+150	+5.0	+15.9
6	Payroll overhead (social security and taxes)	360	378	+ 18	+5.0	+ 1.9
7	Departmental expenses	1,239	1,011	-228	-18.4	-24.2
8	General factory expenses	548	480	- 68	-12.4	- 7.2
9	Overall costs of plant	14,902	17,014	-888	- 6.0	-94.1
10	Selling expenses	320	264	- 56	-17.5	- 5.9
11	Total overall costs of completed production	15,222	14,278	-944	- 6.2	100%

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Column 6 of the compilation shows in which expenditures a reduction in overall costs has been attained. Column 7 makes it possible to analyze in detail the factors that influence the attainment of reduction of overall costs by comparison of material, personnel, and other costs.

By compiling the overall costs in accordance with the expenditures for the entire comparable production, one outlines the sum of the economies gained as a result of reduction in overall costs during the period under consideration as compared with the prior period.

Control over the performance of the plan of reducing overall costs is carried out in accordance with Model 2/XIII.

MODEL 2/XIII

(In 1,000 zlotys)

No	Itemization	Planned Percentage of reduction in costs of comparable production		Percentage share of comparable production cost to total cost of commodity production		Total Overall Cost of Comparable Commodity Production completed from beginning of year to end of report quarter						Cost of Total commodity production for 1954	
						per unit cost				Reduction achieved from beginning of year to end of report quarter			
		Yearly	From beginning of year to end of report quarter	Planned	Actual	Actual 1953	Corrected 1953	Planned 1954	Actual 1954	In comparable conditions $\frac{\text{columns 8-10}}{\text{column 8}}$ x 100	Allowing for planned changes	Planned	Actual
1	2	3	4	5	6	7	8	9	10	11	12	13	14
A	CZP [Centralny Zarzad Przemyslu -- Central Administration of Industry] (ZP) [Zarzad Przemyslu -- Administration of Industry]												
	Total according to computation:												
1	By branch method												
2	By plant method												
B	Including for:												

This form is filled out on the basis of the summary calculations. Filling out this form requires preparatory work. The calculation of the overall sum of the costs, chargeable to each of the items listed in the form, is possible only on the basis of separate calculation data for each type of production as well as by multiplying the average costs per unit production by the number of units of completed production of a given type. Only by summing the products of the individual types of comparable production as well as of the incomparable one will furnish material for the above form.

Control Over the Performance of the Plan for Reduction of Overall Costs

In the analysis of overall production costs it is very important to examine their structure from the point of view of possible reductions in individual components.

The first step in the analysis should be the comparison of the percentage share of the individual expenditures in the overall costs, both planned and actual, not only in the accounting period, but also in the similar period of the past year.

This is very important because during the execution of the plan for cost reduction the sums of certain expenditures are still not known precisely, while the plan is made on the basis of data concerning the predicted performance. Consequently individual calculation expenditures of the plan may turn out to be "excessive" or "too low." Any plan for reduction of overall costs, which is based on predicted performance during the past year, will not reflect the actual reduction in overall cost in the case where the actual overall costs of that period differ from the predicted costs adopted prior to the plan. By the same token the performance of the plan of overall

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cost reduction will not be a true index of their reduction.

Therefore the factor adopted as controlling the reduction of the actual overall costs is the actual overall costs of production during the past period.

The control over the performance of the overall cost reduction plan may include not only individual expenditure components in the production costs but the overall cost per unit production, as well as the entire marketable production, both comparable and noncomparable.

Comparison of overall costs of the entire production created during the accounting period and during the same period of the past year characterizes the general results of overall cost reduction.

An accounting of the performance of the overall cost reduction plan for marketable production permits evaluation of not only the general reduction in overall costs, but also, as indicated above, of the reduction of its individual components.

Effect of Changes in the Material Consumption Norms and Price Changes on the Reduction of Production Costs

In view of the fact that costs of basic raw and other materials have a dominating influence on the overall production cost, a reduced material consumption per production unit exerts a fundamental affect on cost reduction.

However the size of expenditures for raw and other materials depends not only on the value of the consumption norm per unit production but also on the purchase price. Deviations of the actual consumption of raw and other basic materials from the norms established in the plan depends

entirely on the organization and technical conditions of the production, while changes in purchase prices is either independent or very little dependent on the enterprise. It is the task of statistics to control the influence of each of these factors on the size of production overall cost reduction.

Let us illustrate this with an example (see Table 3/XIII).

TABLE 3/XIII

		Plan					Fulfillment				
		Consumed for					Consumed for				
Raw and Basic Materials	Unit of Measure	Unit of production	Total production	Amount of production in units	Unit price of raw material in zlotys	Total cost of zlotys	Unit of production	Total production	Amount of production in units	Price per unit in zlotys	Total cost in zlotys
A	kg	5	5,000	1,000	10	50,000	4.5	4,725	1,050	8	37,800

As a result of Table 3/XIII, the consumption of basic raw and other materials has been reduced by 0.50 kg relative to the raw and other material consumption norm. Taking the unit costs in accordance with the planned purchased price (10 zlotys), we calculate the overall change in overall costs resulting from a change in norm, in accordance with the equation

$$W_1 = \frac{\sum q_1 n_1 p_0}{\sum p_1 n_0 p_0}$$

where q_1 denotes quantity of completed production,

n_1 denotes the actual consumption of raw and other materials per unit product,

n_0 denotes the norm of raw material consumper as per plan, and

p_0 denotes the planned price of unit raw material and supplies.

$$W_1 = \frac{1\,050 \cdot 4.5 \cdot 10}{1\,050 \cdot 5.0 \cdot 10} = \frac{47\,250}{52\,500} = 90\,\%$$

The result is that the enterprise has saved 10% on basic raw materials and supplies as a result of reducing the consumption norm per production unit.

The effect of change in raw material price on production cost can be calculated from equation

$$W_2 = \frac{\sum q_1 n_1 p_1}{\sum q_1 n_1 p_0}$$

where q_1 denotes the quantity of completed production,

n_1 denotes the actual consumption of raw material and supplies per unit production,

p_1 denotes the actual price per unit raw material, and

p_0 denotes the planned price per unit raw material.

$$W_2 = \frac{1\,050 \cdot 4{,}5 \cdot 8}{1\,050 \cdot 4{,}5 \cdot 10} = \frac{37\,800}{47\,250} = 80\%$$

This means that the enterprise has saved 20% by the change in raw material price.

The net reduction in overall cost resulting from more economical material consumption per unit production than specified by the consumption norms, as well as resulting from reduction of material prices is calculated jointly from the equation

$$W = \frac{\sum q_1 n_1 p_1}{\sum q_1 n_0 p_0}$$

$$W = \frac{1\,050 \cdot 4{,}5 \cdot 8}{1\,050 \cdot 5{,}0 \cdot 10} = \frac{37\,800}{52\,500} = 0{,}72\%$$

In other words the reduction in overall cost resulting from a reduction in raw material consumption and a reduction in price is obtained by multiplying the individual saving percentages:

$$\frac{90 \cdot 80}{100} = 72\%$$

This means that the enterprise has saved 28% of the material costs owing to the change in the material consumption norm and the change in their price.

In a similar manner it is also possible to analyze other elements that affect the magnitude of overall costs and changes in prices depending on them. For example expenditures connected with transportation are subject to change depending on the possession of the enterprise's own means of transportation, changes in railway rates and rates of other transportation means, by regrouping suppliers (change in transportation distance), etc.

Effect of Change in Labor Productivity on Reduction of Production Overall Costs

A change in labor productivity and a change in wage norms affects the reduction of overall cost, just as does a change in the norms and prices of material expenditures.

The growth in labor productivity causes a reduction in overall cost only in the case where the tempo of labor productivity growth is faster than the tempo of the growth in wages.

The effect of growth in labor productivity on the reduction of overall costs can be determined by using the equation

$$W = \frac{\Sigma (T_1 N_o q_1)}{\Sigma (T_o N_o q_1)}$$

where T_1 denotes the labor time expended per unit production during the accounting period,

T_o denotes the labor time expenditures per unit production as per plan,

N_o denotes the average wage per hour as per plan, and

q_1 denotes the production performed during the accounting period.

(See example on Page 375)

The reduction in overall costs resulting from increased labor productivity amounts to:

(1) for article A = $\frac{1.8x3.0x50}{2x3.0x50} = \frac{270}{30} = 0.9 = 90\%$;

(2) for article B = $\frac{2.5x2.8x45}{3x2.8x45} = \frac{315}{378} = 0.833 = 83.3\%$.

The total for articles A and B is

$$\frac{(1.8x3.0x50)+(2.5x2.8x45)}{(2x3.0x50)+(3x2.8x45)} = \frac{585}{678} = 0.863 = 86.3\%.$$

Example:

Itemization	Plan		Fulfillment	
	Articles			
	A	B	A	B
Work outlay per unit of production in hours	2	3	1.8	2.5
Average wage per hour	3.0	2.8	3.1	3.0
Weight per unit of production	6.00	8.40	5.58	7.50
Quantity of production in 1,000 pieces	45	45	50	45

As can be seen from the example, the resultant reduction in production costs due to increase in labor productivity amounts to 13.7%.

In order to exhibit the effect of the above factors on cost reduction, the form for statistical accounting for the performance of the plan for reducing production overall costs of marketable production contains questions concerning the effects of changes in price, changes in wage scale, changes in tarrifs, etc, resulting from causes not under the control of the enterprise.

Effect of Changes in Size of Production on the Reduction of Production Overall Costs

The size and rate of reduction of overall costs depends equally on the rate of increase in production. As mentioned above, overall costs are divided into fixed and variable costs. The fixed costs, which include among others, the costs of general administration of the enterprise, do not increase in principle per unit production but on the contrary are subject to reduction with increasing production. This means that the fixed costs calculated per unit production diminish in proportion to the increase in production.

The greater the increase in production, the greater the reduction in overall cost owing to the reduction in fixed costs per unit production.

Assume that the production plan for a given period provides for the manufacture of 1,000 units with a total value of 40,000 zlotys of overall costs, of which 20% represents fixed cost. In this case the fixed cost per unit production according to the plan amounts to

$$\frac{40{,}000 \times 20}{1{,}000 \times 100} = 8 \text{ zlotys.}$$

In this example the fixed cost for the entire production amounts to 8,000 zlotys (1,000x8).

Assume that the enterprise has fulfilled 120, percent of the plan, meaning that 1,200 units were produced. The fixed cost per unit amounts to

$$\frac{8{,}000}{1{,}200} = 6.67.$$

The economy in the entire production amounts to (8 zlotys minus 6.67 zlotys)x1,200 = 1,596 zlotys. Thus the reduction in overall cost due to increased production amounts to

$$\frac{1{,}596}{40{,}000} \times 100 = 3.99\%.$$

3. Indices of the Dynamics of Overall Costs

The plan for reduction of overall costs is established not in absolute numbers, but in relative numbers, which outline the degree of reduction in overall costs during the period under consideration relative to the past period.

The index for the overall costs of individual articles, that is, the individual index, is calculated by dividing the actual overall cost

incurred in the production of the given article during the period under consideration by the actual overall cost in the past period.

Assume that the overall cost of producing a single t of steel amounted to 3,500 zlotys in the accounting period, and 3,550 zlotys in the past period. The overall cost index will amount to

$$\frac{3{,}500}{3{,}500} \times 100 = 98.6\%.$$

This means that the reduction in overall cost was 1.4% (100-98.6) in this case.

The overall cost index for a single article for several enterprises as well as for the entire branch of industry is calculated from the formula

$$\frac{q_1 k_1}{q_1 k_o},$$

where q_1 denotes the production of a given article in individual enterprises during the accounting period and k_1 and k_o denote the overall cost per unit product during the accounting and basic periods.

Example:

Enterprises	Quantity of Production in 1,000 pieces		Overall Unit Cost in zlotys		Overall Cost of Entire Production in 1,000 zlotys during report period according to cost of		
	In basic period	In report period	In basic period	In report period	In basic period	Of basic period	Of report period
I	100	110	2.00	1.80	200	220	193
II	300	300	2.50	2.40	750	750	720
III	50	250	2.00	1.70	100	500	425
Total	450	660	2.33	2.03	1,050	1,470	1,343

Example:

Article	Units Produced during report period	Overall Cost per Unit of article		Value of Entire Production completed during report period according to overall costs of		Individual index
		In basic period	In report period	Basic period	Report period	
A	1,000	10	8	10,000	8,000	80.0
B	500	15	14	7,500	7,000	93.3
C	2,000	9	10	18,000	20,000	111.1
Total	x	x	x	35,500	35,000	98.6

The overall cost index for the production of all the enterprise amounts to

$$\frac{1\,343\,000}{1\,470\,000} \cdot 100 = 91{,}4$$

This is the index for the fixed structure.

The overall cost index for the variable structure is calculated from the formula

$$\frac{\Sigma q_1 k_1}{\Sigma q_1} : \frac{\Sigma q_o k_o}{\Sigma q_o}$$

In our example the overall cost index of the variable structure amounts to

$$\frac{2{,}03}{2{,}33} \cdot 100 = 87\%$$

The overall cost index for the variable structure characterizes the level of average overall costs, which depends not only on changes in the level of the overall cost but also on the quantity of the production of the individual enterprises in the overall production total.

From the economic point of view the calculation of the overall cost index for the variable structure is of great significance in the examination of the dynamics of reduction of overall costs. The average percentage of overall cost reduction is established in the national economic plan principally by taking into consideration the quantity of production of the individual enterprises.

The overall cost indices of a series of articles is calculated from the formula

$$\frac{\Sigma q_1 k_1}{\Sigma q_1 k_o}$$

where q_1 denotes the quantity of produced articles in the accounting period and k_1 and k_o denote the overall cost level per unit of particular article in the accounting and basic periods respectively.

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The overall cost index calculated in accordance with the equation for the aggregate index amounts to

$$\frac{35\,000}{35\,500} \cdot 100 = 98{,}6\%$$

In general the overall costs were reduced by 1.4% (100-98.6%), and examining individual articles we see that in spite of the general reduction of 1.4% in the overall cost the overall cost of article C increased by 11.1%.

The general cost index can also be calculated with a different method namely on the basis of the mean-arithmetic index formula, using the formula

$$\frac{\sum \frac{k_1}{k_o} \cdot q_1 k_o}{\Sigma q_1 k_o}$$

The symbols are the same as before.

The index as calculated in accordance with this formula for the example given above is $\frac{(80.0 \cdot 10\,000) + (93{,}3 \cdot 7\,500) + (111{,}1 \cdot 18\,000)}{35\,500} = 98{,}6\%$

Thus the result is the same as obtained by calculating the index with the preceding method.

The aggregate indices of overall cost give a comparison of the actual sum of expenditures for the production with the sum of expenditures which would have been incurred where the overall costs are to be maintained at the level of the base period.

The index of the fulfillment of the plan for overall cost reduction is calculated on the basis of the actual overall costs of individual articles as related to the costs adopted in the plan.

Because the planned reduction in overall costs is based not on a complete accounting period but principally on predicted data, the planned reduction of overall costs may deviate from the actual overall cost reduction.

This is why in statistical practice one calculates the index both with respect to the plan and with respect to the actual performance in the past year. Only comparison of these 2 indices makes it possible for us to estimate the extent to which the overall cost reduction has been effected (see table).

Example:

Articles	Overall Costs per Unit of production			Units produced in report period	Value of Production of report period according to overall costs		
	Actual for prior year	Planned for report period	Actual for report period		prior year	planned	actual
A	10	9	8	1,000	10,000	9,000	8,000
B	15	14.5	14	500	7,500	7,250	7,000
C	9	9	10	1,000	18,000	18,000	20,000
Total	x	x	x	x	35,000	34,250	35,000

As follows from the example cited, the overall cost index relative to the past year was reduced by 1.4% (100 (35,000/35,500) = 98.6%; 100-98.6 = 1.4%. In relation to the plan the costs increased 2.18% (35,000/34,250x100 = 102.18%).

Control over the performance of the plan for overall cost reduction is effected by the usual comparison of the 2 indices, the index of the plan for overall cost reduction and the index of the actual overall costs of comparable production.

It must be remembered however that complete comparability of these 2 indices takes place only if the structure of the actual production by assortments remains unchanged relative to the structure of the planned production.

In practice one hardly ever finds the structure of the assortment of the production performed to correspond to the structure of the assortment of the planned production.

This is why it must be remembered in the control of the plan for overall cost reduction that the overall cost index is affected not only by the change in overall costs of individual articles but equally by a change in the assortment of the comparable production relative to the planned assortment.

Example:

Articles	Units Produced		Overall Cost of unit		Value of Planned production according to		Value of Actual production	
	plan	actual	plan	actual	planned	actual	planned	actual
A	1,000	1,000	10	9	10,000	9,000	10,000	9,000
B	500	1,500	8	7.5	4,000	3,750	12,000	11,250
Total	x	x	x	x	14,000	12,750	22,000	20,250

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The overall costs index for the planned production amounts to

$$\frac{\Sigma q_0 k_1}{\Sigma q_0 k_0} = \frac{12\,750}{14\,000} = 0{,}911 = 91{,}1\%$$

The overall costs index for the actual production is

$$\frac{\Sigma q_1 k_1}{\Sigma q_1 k_0} = \frac{20\,250}{22\,000} = 0{,}920 = 92{,}0\%$$

The index of overall cost change as a result of changes in the assortment of the comparable production is computed from the equation

$$\frac{\Sigma q_1 k_1}{\Sigma q_1 k_0} : \frac{\Sigma q_0 k_1}{\Sigma q_0 k_0} = \frac{92{,}0}{91{,}1} = 1{,}0\%$$

That means that the overall costs index as a result of shifts in the assortment increased by 1.0%.

Branch Method of Computing the Overall Costs Index

Up to now the discussion of methods for the computing of the overall costs index of comparable production covered the overall costs index for one article of a given enterprise, one type article for several enterprises, and various articles in one enterprise. We can compute the overall costs index for several enterprises for example for a central administration of industry producing a variety of articles by (a) the plant method and (b) the branch method.

The overall costs index computed by the plant method is calculated on the basis of the simple addition of the actual overall costs of the comparable production of the enterprises and the costs of the same production computed from the unit overall costs of the basic (prior) period.

In computing the overall costs index by the "branch method," one takes into account the noncomparable production for a given enterprise but comparable within the framework of the central administration of industry to which the enterprise belongs. That means that beside the items included in the comparable production for the enterprise the index also includes those items which are produced in this enterprise for the first time but which were produced elsewhere within the central administration during the basic period.

The overall costs index as computed by the branch method expresses the ratio of the overall costs of the actual comparable production within the framework of the central administration during the period under report computed from the weighted mean costs of the basic period.

We will illustrate the computation of the overall costs index by the plant and branch methods from the example given in the following table.

(See Table on Page 387)

The index computed by the plant method amounts to

$$\frac{17,240}{19,380} = 0.8895 = 88.95\%.$$

The index computed by the branch method amounts to

$$\frac{19,838}{22,498} = 0.8817 = 88.17\%.$$

The index of overall costs when computed by the plant method shows a decline of 1.05% (100-88.95) and when computed by the branch method of 1.83% (100-88.17).

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Example:

Enterprises	Articles	Units Produced during basic period	Units Produced during report period	Overall Cost Per unit of production during basic period	Overall Cost Per unit of production during report period	Overall Cost According to mean weighted price during basic period	Overall Cost According to mean weighted price during report period	Overall Cost of Comparable production during report period by plant method during basic period	Overall Cost of Comparable production during report period by plant method during report period	Overall Cost of Comparable production during report period by branch method during basic period	Overall Cost of Comparable production during report period by branch method during report period
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
1	A	1,000	1,200	8	7	8.09	7.00	9,600	8,400	9,708	8,400
	B	150	200	10	9	10.00	10.66	2,000	1,800	2,000	2,132
	C	50	-	15	-	11.00	-	-	-	-	-
2	B	-	100	-	14	10.00	10.66	-	-	1,000	1,066
	C	200	250	10	8	11.00	8.00	2,500	2,000	2,750	2,000
	D	-	80	-	20	22.00	20.75	-	-	1,760	1,660
3	A	100	-	9	-	8.09	-	-	-	-	-
	D	200	240	22	21	22.00	20.75	5,280	5,040	5,280	4,580
Total		-	-	-	-	-	-	19,380	17,240	22,498	19,838

In computing the index of overall costs by the branch method it must be borne in mind that the branch index reflects not only the change in the level of overall costs but also the change in the share of the individual enterprises in the structure of the studied phenomenon. Changes in the level of overall costs should be studied simultaneously by both plant and branch methods. The index obtained by the plant method evaluates the work of a given enterprise and the one computed by the branch method gives an evaluation of the work of all the enterprises in a given central administration of industry.